CONFERENCES

IMPERIAL AGRICULTURAL RESEARCH CONFERENCE, 1927

Abstracts of Papers

on

Agricultural Research

in

Great Britain

and

Northern Ireland,

published during the year October, 1926 to September, 1927.

REFERENCE ONLY

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In September, 1927, there was prepared and issued to the Imperial Agricultural Research Conference, a publication containing abstracts of certain papers by research and advisory workers in Great Britain which had been published in the first half (October, 1926, to March, 1927) of the academic year, 1926-27.

In the present volume abstracts of papers published in the second half (April, 1927, to September, 1927) of that academic year have been added to those previously issued, in order to complete the review of British agricultural research work for the period of a full academic year.

The present volume includes papers dealing with work in Northern Ireland in addition to those relating to English, Welsh and Scottish work.

The papers abstracted have been limited to those dealing with results or methods of work. The abstracts have for the most part been made by the investigators themselves. In a few cases, however, abstracts are reproduced from the Reviews of Applied Entomology and Mycology. The abstracts have been arranged on the basis of subjects as shown in the Contents Sheet. In the case of each author the research institute or advisory centre is shown. Under each subject research institute work is given first, followed by advisory centre work.

A copy of the present volume is issued to all agricultural research workers whose names appear in the companion volume "List of Agricultural Research Workers in the Empire." Further copies can be obtained price 1s., post free.

W. R. BLACK,

Secretary to Conference.

10, Whitehall Place,
London, S.W. 1.
May, 1928.

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(1) SOILS AND PLANT NUTRITION.

ROTHAMSTED EXPERIMENTAL STATION.

BRENCHLEY (W. E.), MASKELL (E. J.) & WARINGTON (K.). **The Inter-relation between Silicon and other Elements in Plant Nutrition.** *Ann. App. Bio.*, 1927, vol. xiv, pp. 45–82.

The rôle of silicon in plant nutrition has attracted much attention owing to the large amount that is found in cereal plants, but the true function of the element is still debatable. Widespread belief exists that silicon is capable of replacing phosphorus or other essential elements to some extent, and experiments were undertaken to endeavour to throw light on this point.

Under controlled conditions in water cultures, soluble silicate was found to have little effect upon the growth of barley if phosphorus was also present, but if the latter were absent, a significant increase in dry weight was induced by the silicate. The addition of silicate caused an appreciable increase in the height of the main shoot, which was most marked in phosphate-free solutions, becoming less evident as the quantity of phosphate present was increased. Leaf development was retarded by phosphate deficiency, and hastened by the addition of silicate. A close association exists between the amount of phosphate present, and the effect of silicate upon the rate of tillering and the number of tillers developed.

The possibility of obtaining soluble silicates in considerable quantity from certain manufacturing processes led to an enquiry as to whether such silicates could advantageously be used to supplement or even replace certain of the artificial fertilisers in common use. Soluble silicates tend to cause increase in dry weight with deficient mineral manuring, and in some cases also with complete manuring, and they are more active in this respect than are glass silicates. Further soil experiments revealed variations in the response of barley and mustard to silicate on different types of soil. A general improvement occurred with increasing doses of silicate together with various combinations of manures, notably when phosphorus or potash was deficient.

The significance of the results obtained has been examined statistically, and an attempt made to formulate the effect of added silicate in terms of an increase in the efficiency of the superphosphate present.

BRENCHLEY (W. E.) & WARINGTON (K.). **The Rôle of Boron in the Growth of Plants.** *Ann. Bot.*, 1927, vol. xli, pp. 1–21.

The important rôle of boron in the nutrition of *Vicia faba* was clearly shown in Warington's earlier work, but it remained to be proved whether the beneficial action of the element is a general phenomenon or is confined to particular conditions of growth. Further experiments suggest that the need of certain plants for boron is unaffected by the nature of the substratum on which they grow, the conditions of aeration at the roots, or, in the case of leguminous plants, the presence or absence of nodules, thereon. Plants grown in water cultures need the element irrespective of the composition or pH value of the nutritive solution. The concentration of boric acid appears to be of little moment provided that an adequate, though not excessive, total supply is provided over a given period, but this total supply can be reduced when the nutritive solution is frequently renewed. The need for boron still manifests itself even when the nutrient is kept at approximately constant concentration by means of drip cultures.

Boron *per se* is shown to be the active principle in these phenomena, for the chemical combination in which boron is presented to the plant is immaterial, even the so-called "insoluble" borates being effective; but no other element, out of fifty-two tested, has proved capable of replacing boron. Special attention has been given to manganese in this connection. It has been claimed by other workers that boron is probably essential to the growth

of all plants, but so far in these experiments this has only been proved for several leguminous plants and for melon, whereas various cereals and candy-tuft complete their development in its absence. It is not yet certain whether the distinction between these two classes is real or merely a matter of degree, *i.e.*, whether the second class require so little boron that a sufficient supply is stored up in their seeds. The physiological function of boron in the nutrition of broad bean is under investigation. Boron is not able to replace any one of the essential nutritive elements, but a definite association with the absorption or utilisation of calcium is very strongly marked. The boron does not act as an ordinary catalyst, but is itself absorbed, and in some way removed from action, a constant supply thus being necessary.

CROWTHER (E. M.). **The direct determination of distribution curves of particle size in suspensions.** *Journ. Soc. Chem. Ind.*, vol. xlvi, No. 12, pp. 105–107.

An apparatus is described for obtaining continuous size—distribution curves of suspensions through measurements of the changes with time of the density at a given depth.

A highly sensitive differential liquid manometer connected between two points near the base of the sedimenting column is used to secure sufficient magnification for direct readings.

This method has the advantage over the older methods of Oden and Wiegner in that it is not necessary to evaluate the second differential coefficient of the measured quantity against time in order to allow for the variation of density with both depth and time.

CROWTHER (E. M.). **A Manometer apparatus for the direct determination of summation percentage curves in Mechanical Analysis.** *Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C., 1927.

CROWTHER (E. M.). **Nomographs for use in Mechanical Analysis calculations.** *Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C., 1927.

Description of nomographs facilitating the corrections for temperature, etc., during mechanical analysis.

CROWTHER (E. M.). **Some Physical properties of heavy alkaline soils under irrigation (in the Sudan Gezira).** *Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C., 1927.

CUTLER (D. W.) & BAL (D. V.). **Influence of Protozoa on the Process of Nitrogen Fixation by** *Azotobacter chroococcum*. *Ann. App. Bio.* 1926, vol. xiii, pp. 516–534.

Increased nitrogen fixation by *Azotobacter chroococcum* in the presence of protozoa has been shown to occur, as previously described by Nasir (*Ann. App. Bio.*, vol. x, pp. 122–133).

There is a definite relationship between the efficiency of the strain used, the incubation period, and the concentration of mannitol used.

The feeding action of *Colpidium colpoda*, and *Hartmanella hyalina* on Azotobacter has been demonstrated.

The reason for increased nitrogen fixation appears to be due to the efficiency of Azotobacter being maintained for a longer period as a result of the feeding action of the protozoa, together with the conservation in the bodies of the protozoa of the nitrogen fixed by the bacteria on which the protozoa have fed.

CUTLER (D. W.). **Methods in Soil Protozoology.** *Abderhalden's Handbuch der Biologischen Arbeitsmethoden.*

An account is given in German of the modern technique used for the study of soil protozoa.

CUTLER (D. W.) & DIXON (A.). **The effect of soil storage and water content on the protozoan population.** *Ann. App. Bio.* Vol. xiv, pp. 247–254.

Experiments are described showing that it is possible to conduct laboratory experiments on micro-organisms in stored soil, providing the surface of the soil is large relatively to its volume.

Experiments on the influence of moisture on the soil protozoa show that active forms are found in soils containing a very low percentage of water.

Four common soil protozoa were found to behave normally in soil of $\frac{1}{2}$ and $\frac{1}{3}$ the water-holding capacity, which previously had been air-dried and then brought to the desired water content.

Field soils having water contents of 6 per cent. in one case and 4 per cent. in another corroborated the laboratory experiments. In all of these samples active *Cercomonas* were found, other protozoa being present only in the form of cysts.

CUTLER (D. W.) & CRUMP (L. M.). **The qualitative and quantitative effects of food on the growth of a soil amoeba** (*Hartmanella hyalina*). *Brit. Journ. Exp. Bio.*, Vol. v, pp. 155–165.

A definite relationship between the reproductive rate of a soil amoeba *Hartmanella hyalina*, and the available bacterial food supply has been demonstrated.

It has been shown that three species of soil bacteria have different feeding values not only in respect to the rate of division of the amoeba, but also in respect to the total increase in the amount of protoplasm.

The bearing of these results on the soil economy is discussed.

DIXON (A.). **The effect of phenol, carbon bisulphide and heat on soil protozoa.** *Ann. App. Bio.* (In the Press.)

Experiments made to discover the death-point of protozoa by phenol, carbon bisulphide and heat showed that phenol has a greater lethal effect than carbon bisulphide.

Heating the soil in a steamer for 30 minutes is usually sufficient to kill off the protozoa, and the treatment of glasshouse soil by steam destroys the majority of the protozoa and has a depressing effect on their numbers for a long period.

EDEN (T.) & FISHER (R. A.). **The experimental determination of the value of top dressings with cereals.** *Journ. Agric. Sci.*, vol. xvii, pp. 548–567.

A simple account of a top dressing experiment carried out at Rothamsted in 1926, with especial reference to the design of such experiments in general, to the statistical analysis of the data, and to the precision in fact attained. The experiment was of 96 plots of winter oats and designed to test with precision the return from top dressings applied early or late, in single or double quantities, and using sulphate or muriate of ammonia. All possible combinations of these conditions were used, the whole having eightfold replication. The results possessed a higher level of precision than any previously attained on conditions which allow of a valid estimate of errors, the standard error of each comparison being only 1·4 per cent. It is, then, of an order which

allows of the discussion of the monetary return to the industrial farmer in relation to the cost of manure and labour. The experiment is one of a programme of research into top dressings, which it is hoped can be maintained at the same level of precision.

GRAY (P. H. H.) & THORNTON (H. G.). **Soil Bacteria that Decompose Certain Aromatic Compounds.** *Centralblatt für Bakteriologie.* II. Abt. Bd., 73.

208 strains (25 species) of soil bacteria that can use phenol, cresol, or naphthalene as their sole source of energy have been isolated from 245 soils widely distributed in Great Britain, Norway, the Tyrol, and islands in the Atlantic. They are more common in arable soil. One species (74 strains) is more abundant in dry than in wet districts. A new genus, *Mycoplana*, has been formed to include a type having motile branched cells. The increased bacterial flora following treatment of soil with phenol is largely due to one species of *Micrococcus*.

HAINES (W. B.). **Studies in the Physical Properties of Soils. IV. A Further Contribution to the Theory of Capillary Phenomena in Soil.** *Journ. Agric. Sci.* 1927, vol. xvii., pp. 264–290.

The pressure deficiency produced by capillary forces in the soil water has been directly measured for several simple materials approximating to the ideal case. The results are shown to throw considerable light on the problem of capillary rise in soils which has received so much attention from soil physicists.

KEEN (B. A.). **Agricultural Science and Artificial fertilizers. The History and Development of the use of Superphosphate.** *Paper presented to the Conference of Superphosphate Manufacturers.* Oct., 1926.

The salient facts and broad generalizations in plant nutrition emerged from the methods of Lawes and Gilbert. Their unparalleled series of field records and laboratory analyses gave a far wider range of information than that for which they were originally designed. The simultaneous development of the fertilizer industry enabled the new knowledge to be applied to farming, thus starting a new chapter in the history of agriculture. At the same time, new problems appeared, many of which have not yet been solved and much more scientific work is required for their ultimate solution—academic and remote from practice as it may occasionally appear to be.

KEEN (B. A.). **Some Physical and Physico-Chemical Effects of Soil Organic Matter.** *Journ. American Soc. Agron.*, Vol. 19, pp. 362–368. 1927.

This paper was written at the request of the American Society of Agronomy to serve as the opening paper in a Symposium on Soil Organic Matter. It discusses the subject with special reference to work at Rothamsted.

KEEN (B. A.). **The value of the dynamometer in cultivation experiments and in Soil physics research.** *Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C., 1927.

A summarised account of the work at Rothamsted on soil cultivation with special reference to the existence of soil heterogeneity as disclosed by dynamometer measurements.

KEEN (B. A.) & COUTTS (J. R. H.). **The use of single value factors in specifying the field behaviour of a soil.** *Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C., 1927.

A study has been made on some forty different soils of certain measurements that attempt to specify the physical characteristics of a soil by a single number as opposed to a mechanical analysis, that involves some five or six numbers (or percentages) for each soil. Significant correlations have been obtained between the determinations and other physical properties of the soil. This work will form the basis for a co-operative study by members of the 1st commission of the International Society of Soil Science.

KEEN (B. A.). **The limited role of capillarity in supplying water to plant roots.** *Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C., 1927.

Observations made with special soil cylinders at Rothamsted, extending over the great drought of 1921, show that water some 2-3 feet below the surface can only reach the surface exceedingly slowly. The capillary movement of water is therefore very small and plant roots cannot obtain much water by this means.

PAGE (H. J.). **The Nature of Soil Acidity.** *Trans. II. Comm. Internat. Soc. Soil Science*, vol. A, Groningen, 1926, pp. 232–244.

A discussion of the nature of soil acidity in the light of modern views on the ionic exchange relationships of the soil colloids. The views of Kappen, who distinguishes four different types of soil acidity, are criticised. It is maintained that the conception of the absorbing complex of the soil as consisting of an insoluble colloidal acid, or "acidoid," with which are associated surface-active hydrogen and basic cations, brings into line the majority of the known physico-chemical properties of the soil. The different types of acidity postulated by Kappen can all be regarded as manifestations of the same property of the complex, namely, the tendency of metallic cations to exchange with hydrogen ions as well as with other cations.

PAGE (H. J.) & WILLIAMS (W.). **The Effect of Flooding with Sea Water on the Fertility of the Soil.** *Journ. Agric. Sci.*, 1926, vol. xvi, pp. 551–573.

The flooding with sea-water of land around the Humber in 1921 spoilt a considerable area of arable land.

The effects of the flooding, which consisted chiefly in an entire destruction of the tilth of the soil, are described, and compared with the recorded effects of similar floods in Holland and in Essex.

The results of an examination of the exchangeable bases in the flooded soil are considered in the light of modern work on the relation between the nature of the exchangeable bases in the soil and its physical condition. It is shown that the observed effects can be explained by replacement of a considerable proportion of the exchangeable calcium of the soil by sodium.

Dutch experience on the reclamation of flooded soils is discussed. It is shown that in the first few years after flooding, the land should be cultivated as little as possible.

The use of lime or gypsum for the treatment of flooded soils, in order to hasten the restitution of calcium to the clay in place of sodium, is discussed. From an examination of the soil from plots which had been treated with these materials, it is shown that, although both produced in some degree the desired effect chemically, the action did not proceed far enough in 12 months to produce a noticeable improvement in the tilth.

It may be possible under favourable conditions to grow certain arable crops on flooded land, among which cruciferes appear to be specially suitable. However, the most satisfactory and promising means of hastening the recovery of tilth and fertility by flooded land appears to be the establishment of a ley of lucerne, clover, or "seeds" which can be left down for several years.

PAGE (H. J.). **The Investigations of K. K. Gedroiz on Base Exchange and absorption.** *Trans. II. Comm. Internat. Soc. Soil Science*, vol. A., Groningen, 1926, pp. 208–231.

An important series of papers published by Dr. Gedroiz in Russia, from 1912–1925, is reviewed. The investigations cover a wide range of physico-chemical soil phenomena, dealing with the physical properties of soils, their mode of origin and degradation, the formation of alkali soils and of acid soils, the classification of and relation between different soil types and the absorptive relations of soils to salts.

PAGE (H. J.). **Section on Soil and Plant Biochemistry in the article on Biochemistry.** *Ann. Reports Chem. Soc.* 1926, vol. xxiii.

A review of the literature.

PAGE (H. J.). **Article on Soils and Fertilisers in the Reports of the Progress of Applied Chemistry.** *Soc. Chem. Ind.* 1926, vol. ii.

A review of the literature.

PAGE (H. J.). **The Place of Green Manuring in British Agriculture.** *Essex County Farmers' Year Book.* 1927.

The possibilities and limitations of green manuring in practice are discussed.

PAGE (H. J.) & MARSHALL (C. E.). **The origin of humic matter.** *Nature.* 1927, 119, 393.

Fractionation of humic material by sulphurous acid gave substances resembling lignosulphonic acids. The possible relationship between lignin and natural humic acids is discussed.

REGE (R. D.). **Bio-chemical Decomposition of Cellulosic Materials—with Special Reference to the Action of Fungi.** *Ann. App. Biol.*, vol. xiv, part I. Feb., 1927.

In nature plant materials pentosans form the most important food for micro-organisms.

The Klober and Tollens method for the determination of pentosans is not specific for these compounds.

While pentosans are easily attacked by micro-organisms, the other furfurol-yielding compounds are found to be resistant and it is therefore essential to get a correct figure for pentosans. A possible method is suggested:—to determine the furfuroids in the cellulose obtained by the chlorination method and to deduct this amount from the total furfuroids.

Two factors appear to control the decomposition of ripe cellulosic materials in the presence of assimilable nitrogen. The one is the food or, better termed, *energy factor* which is the pentosans, the other is the physical or *inhibitory factor* which is the lignin. It is found that if the ratio of energy factor to inhibitory factor is above I, the material is easily decomposed ; but if it is

below 0·5, the material is very resistant to microbial attack. The prediction of the "decomposibility" of a material is thus possible.

Attempts to increase this ratio in resistant materials by the addition of carbohydrates proved unsuccessful. It was concluded that since micro-organisms obtained their food materials outside the tissues, they did not attack the tissues until the more easily available food-stuffs were exhausted. Thus the decomposition of the material was actually less than was possible under natural conditions.

Mannose and galactose do not appear to form suitable food for the micro-organisms concerned in these processes, and it is concluded that the pentosan part of the hemi-celluloses is most important as microbial food.

A study of the relative importance of bacteria and fungi proves that under the conditions of these experiments, fungi play a more prominent part, especially during the early stages of such decomposition.

The study on the availability of the nitrogen of the fungal bodies proves it to be of the resistant type. It seems that at later stages of decomposition under natural conditions fungi are decomposed by other organisms.

The ability of certain fungi isolated from such decomposing heaps to grow at high temperature as well as on purified carbon constituents of plants, and also the presence of almost all the enzymes necessary to hydrolyse the complex carbon constituents, further confirm their importance. The possibility of their activity under natural conditions in manure heaps is strongly suggested.

Sandon (H.). **The Methods and Present State of the Study of Soil Protozoa.** *Uspiechin Biologitsheskich Nauk.* 1927.

In this paper a detailed account of the present day technique of soil protozoology is given, together with a brief description of the more recent developments of the subject. It forms one of a series of papers on the modern methods of soil research, edited by Professor Omelianski for the benefit of investigators in Russian-speaking countries.

Sandon (H.). **The Composition and Distribution of the Protozoan Fauna of the Soil.** 1927. *Biological Monographs and Manuals*, Oliver and Boyd, Edinburgh. 15s.

In this volume the scattered records of the occurrence of protozoa in soils are collected together and compared with the observations made at Rothamsted, with the object of analysing the factors influencing their distribution and abundances in the soil. Descriptions are added of most of the forms known to occur, with keys for their identification and figures of many of the commoner species.

Skuhra (C. E.). **The effect of protozoa and fungi on certain biochemical processes when inoculated into partially sterilized soil.** *Soil Sci.*, Vol. xxiv, pp. 149–161.

Soil was partially sterilized by heating and reinoculated with various agents.

Hartmanella hyalina caused a reduction in the number of bacteria and a slight depression in CO_2 evolution and NH_3 accumulation.

Trichoderma koningi and *Penicillium* sp. caused an increase in CO_2 evolution and a decrease in NH_3 accumulation.

Partial sterilization phenomena are discussed in relation to these findings.

Subrahmanyan (V.). **Biochemistry of waterlogged soils, Part I.** *Journ. Agric. Sci.*, 1927, 17, 429.

The waterlogging of Rothamsted and Indian soils in the absence of fresh organic matter caused little change in the total nitrate, or nitrite nitrogen,

but a considerable increase in ammonia. There was no evidence that this ammonia was produced by the ammonifying organisms capable of liquefying gelatine.

Ibid, p. 449 (Part II). The formation of ammonia in waterlogged soils took place even in the presence of antiseptics and was shown to be due to an enzyme. An active preparation of a diaminase, capable of attacking amino-acids but not proteins, was extracted by glycerol.

Ibid, p. 468. (An improved method for the estimation of dissolved oxygen in water). Thresh's method, which was susceptible to error through the volatilisation of iodine, was modified to eliminate this loss; the necessity for separate determinations of dissolved oxygen in the reagents was obviated.

THORNTON (H. G.) & FISHER (R. A.). **On the Existence of Daily Changes in the Bacterial Numbers in American Soil.** *Soil Science*, vol. xxiii, No. 4. April, 1927.

The daily bacterial counts published by Smith and Worden show variations which cannot be explained by unequal distribution of bacteria in the soil, or by seasonal changes in bacterial numbers.

On all three media employed by them, significant positive correlations in bacterial numbers between simultaneous samples were obtained.

The similar daily fluctuations occurring in different parts of the plot show most clearly on Thornton's mineral salts medium.

Provided the manipulative technique of Smith and Worden was sufficiently uniform, the results afford evidence of the existence, in very different conditions, of fluctuations in bacterial numbers similar to those observed at Rothamsted.

UNIVERSITY OF BRISTOL AND LONG ASHTON FRUIT RESEARCH STATION.

LING (A. W.). **Some Effects of Phosphatic Manures and Ground Lime on Acid Pastures.** *Journ. Bath and West and Southern Counties Soc.*, Vol. i, pp. 49–78. 1926–1927.

Results of an investigation of the effects of phosphatic manures and ground lime after one year's contact with the soil of certain acid pastures are reported. Soil and herbage data are given to indicate the general condition of the fields before treatment.

Data on the acidity of the soil as measured by the usual standard methods are presented. From these data it is found that phosphatic manures do not consistently reduce the acidity, but lime in every case decreases the lime requirement.

Data on the composition of the 1 : 5 soil extract before and after a year's treatment with phosphatic manures and lime are given. The salient points obtained from these analyses are:—

Phosphatic manures and lime increase the total solids.
Phosphatic manures and lime increase the phosphorus.
Slag and lime increase the potassium.
Slag decreases the iron, aluminium and manganese, but the results are not so definite with the other manures.

The results of general field observations on the plots at various intervals are recorded.

The botanical composition of the herbage is considered and it is found that the percentage of the clovers is greatly increased on the phosphate plots and the proportion of useless grasses and weeds decreased.

The fibre content from the grass plots receiving phosphate is shown to be reduced. It is also demonstrated that phosphatic manures increase the moisture content of the grass.

LING (A. W.). **Sugar Beet Experiments (Manuring) in the West of England, 1926.** *Bull. No.* 1, *Univ. Bris.*

Contains results obtained from a uniform set of manurial trials in Wiltshire (9 centres), Somerset (5 centres) and Gloucestershire (3 centres). The results are discussed under the following headings:—(*a*) Effect of manures on yield. (*b*) Effect of manures on sugar content. (*c*) Effect of top dressings on yield. (*d*) Effect of top dressing on sugar content.

The data are considered in relation to soil type and general recommendations as regards manuring are made.

LING (A. W.). **Sugar Beet Experiments.** *Agric. Prog.*, Vol. iv, 1927.

Details are given of a suggested uniform scheme for cultivation and manurial trials in connection with sugar beet. Particulars of a uniform method of sampling, dirt estimation, and sugar determination are appended.

LING (A. W.). **Sugar Beet (Manuring) in the West of England.** *Brit. Beet Grower*, Vol. I, No. 1, Sept., 1927.

A detailed description is given of sugar beet trials conducted in the West of England during the seasons 1925 and 1926. Much of the information contained in Bulletin No. 1 (see above) is incorporated in this article.

WALLACE (T.). **Fruit Soils Surveys.** *Bath and West Journ.* 1926–27.

The paper deals primarily with the programme of work which is in progress at Long Ashton Station on the relation between soil conditions and the growth of fruit trees.

The programme is discussed under the following headings—(1) Aims of the surveys, (2) Uses of the work, (3) Methods of working, (4) Records and publication of results.

A summarised account is given of the work previously carried out on two types of soil on the Old Red Sandstone areas around Bromyard and Ross-on-Wye.

It is shown that in both areas there is a marked correlation between certain soil conditions as indicated by field observations and mechanical analyses and the growth of fruit trees such as apple, plum and cherry trees.

WALLACE (T.). **An Experiment on the Winter-Killing of Vegetable Crops in Market Gardens.** *Bath and West Journ.* 1926–27.

Market gardeners in the Bristol area experience great difficulty in growing winter crops such as winter onions, winter lettuces and spring cabbages in gardens which have been utilised for a number of years for market garden purposes.

The plants which usually die out during periods of cold weather make very poor root systems and the tops either exhibit symptoms of dying back from the tips—*e.g.*, onions—or dying out around the margins of the leaves—*e.g.*, winter lettuces.

The soils in the gardens are mostly derived from light Pennant Sandstone or heavy Lias clay.

It is the custom to apply extremely heavy dressings of town stable manure to the gardens—40 to 100 loads per acre being usual, and as a result of this treatment the soils of the older gardens contain high percentages of organic matter and are "light" and "puffy" where derived originally from sandstone or clay.

Winter onions were grown on selected plots in a typical garden, one-half of the plants receiving no manure and the remainder sulphate of potash at

a rate of 3 cwts. per acre. The plants on the unmanured plot showed the usual winter-killing condition and many died out, whilst those receiving the potash treatment made large root systems and developed into healthy plants.

It is suggested that the poor rooting results from a high $\frac{\text{nitrogen}}{\text{potassium}}$ ratio.

A recommendation for the manuring of such gardens is made.

WALLACE (T.). **Field Experiment on the Manuring of Gooseberry Bushes.** *Journ. Pom. and Hort. Sci.*, Vol. vi, No. 3, September, 1927.

A field manurial experiment on gooseberry bushes, variety Keepsake, carried out over a period of six seasons is described.

The soil on the area is a fine sandy loam derived from the Keuper Marl formation and varies over the area across the manurial plots which were laid out in strip fashion in duplicate.

The growth of the bushes on the heavier soil area was good even when no manure was applied but on the lighter portion healthy growth could not be obtained without appropriate manurial treatment.

The manurial treatments included dung, complete artificials supplying nitrogen, potassium and phosphorus, and artificials omitting nitrogen, potassium and phosphorus respectively.

Data are presented relative to growth characters, leaf scorch control, botrytis infection and cropping.

The results show that certain effects are attributable to soil variation and others to the action of the manures—dung and complete manures.

Potassium was found to be the limiting factor to the growth of gooseberry bushes over the area and the application of potash manures produced significant effects in increasing growth and cropping and in controlling leaf scorch. The application of manures containing nitrogen and phosphorus but no potassium apparently affected the growth and cropping of the bushes adversely.

Potash manures did not exercise any controlling action against botrytis infection.

The qualitative effects produced by dung were similar to those resulting from complete artificial manures.

UNIVERSITY OF LEEDS.

COMBER (N. M.). **Methods of Determining Soil Acidity. A Critical Report of the Proceedings of the International Conference held in Holland, April, 1926.** *Intern. Congress Soil Sci.*, Washington, 1927.

The preparation of the sample, while manifestly of fundamental importance, has not received adequate attention. The drying out of the soil in the laboratory and the extent to which it is ground up in a mortar, may have important effects on an ultimate determination of hydrogen-ion concentration.

The manner of the preparation of the suspension of the sample is not universally agreed upon, some workers preferring to use aqueous suspensions and others suspensions in potassium chloride. The Second Commission recommend that the pH of suspensions in water should always be determined and that of suspensions in KCl solution in addition when possible.

The recent work of Biilmann and Jensen removes many misgivings about the value of the quinhydrone electrode for the determination of pH. The Commission feel justified in recommending that the quinhydrone electrode be used except perhaps for soils more alkaline than pH=8·5.

COMBER (N. M.). **The Study of the Soil Profile.** *Brit. Assoc.*, Leeds, 1927.

It has frequently been said that because the profiles of British soils are for the most part not so fully developed as in Russia and elsewhere, and that

because the influence of the parent material is still apparent, and because the soils are for the most part cultivated, profile studies are of small significance in this country. It is contended in this paper that the circumstances in question merely make profile study more difficult and not less significant. Profile studies are of primary importance because they constitute the principal clue to the processes going on in the soil upon which all soil properties, whether of academic or practical interest, depend.

COMBER (N. M.) **An Introduction to the Scientific Study of the Soil.** *Textbook published by Messrs. Ed. Arnold & Co.*

This book is an attempt to set forth in a concise manner and mainly in the interests of agricultural students, the salient facts of our present knowledge of soil constitution and phenomena.

COMBER (N. M.) **Guide to Excursion to Yorkshire Soils.** *Brit. Assoc.*, Leeds, 1927.

A number of profile studies have been commenced at this centre and the Agricultural Section of the British Association, at the request of its Committee, were taken on an excursion in which the profiles under examination were seen. The Guide gives an account of the profiles so far as they had been studied and deals with the agriculture of the route taken.

HUNTER (—) & MILLARD (W. A.). **The Improvement of Poor Pasture in Yorkshire.** *Univ. Leeds & Yorks. Council for Agric. Educ.*

The report summarizes the experiments for the past ten years. Their object was to ascertain (1) the relative values of lime and basic slag, and (2) the relative values of different forms of phosphate in the regeneration of sour pastures. Plots were laid down on different types of soil comprising soils derived from the Millstone Grit and Coal Measures, soils overlying limestone and alluvial soils. On the soils overlying the Millstone Grit and Coal Measures the natural grassland flora was found to be very limited, and to consist largely of bents, fescues, Yorkshire fog, woodrush and sheep's sorrel. A "mat" of dead material was invariably present. On such pastures the response to lime was extremely good whilst basic slag produced practically no effect. Under the action of lime the "mat" gradually disappeared, and there was a great increase of wild white clover: fine leaved fescues tended to increase and sometimes bent grass. Apart from the increase of wild white clover the beneficial change brought about consisted rather in the more succulent growth of the existing grasses than in any radical change of flora. On pastures in limestone areas the flora was much more varied, and the "mat" was not so pronounced. The dominant weeds were upright brome and false brome. Such pastures responded most readily to phosphate whilst lime alone exerted little effect, even where there was a definite lime requirement. High grade slag and low grade slag (of high citric solubility) were generally more rapid in action than low grade slag (of low citric solubility) and the mineral phosphates, but the ultimate degree of improvement varied little. This improvement reached a maximum in 3–6 years according to the form of phosphate used after which deterioration set in. This was not counteracted by the further addition of phosphate, but where lime in addition to phosphate was applied the improvement was more permanent.

UNIVERSITY OF READING.

DAVIES (W. L.). **The variation in Hardness of Thames and Kennet (Berks) Waters during the Rainy Seasons.** *Water & Water Engineering*, Vol. xxix, No. 345, p. 366.

Analyses of samples of Thames (Pangbourne) and Kennet (Theale) waters every ten days during the period November, 1926—April, 1927, revealed that

heavy rainfall had little effect on temporary and permanent hardness of calcareous waters. The time of recovery to normal was short, permanent hardness recovering sooner than temporary. In a slow moving river, recovery was slightly slower than in fast running rivers. Temporary hardness accounted for 85-90 per cent. of the total hardness. Water temperature varied very little from the mean. In connection with winter irrigation of meadows, there is nothing to be gained from early watering, if quality of water is supposed to be better in late autumn.

SEALE-HAYNE AGRICULTURAL COLLEGE, NEWTON ABBOT.

VANSTONE (E.). **Some Experiments on Basic Slags.** *Agric. Prog.*, Vol. iv. 1927.

The composition of basic slags was investigated by decomposing the lime compounds by boiling ammonium chloride. The residues were much richer in phosphate. The chief conclusions were :—

The lime compounds are readily decomposed.

In high soluble slags the phosphate is present as a silico-phosphate.

In low soluble slags a basic tetra-calcium phosphate is present.

The lime present in basic slags is a factor of great importance, it is present in large quantity as dicalcium silicate, which is an important source of available lime.

SOUTH EASTERN AGRICULTURAL COLLEGE.

BURGESS (A. H.). **Report on Manuring Experiments on Hops, 1925.** *Journ. Inst. Brew.*, xxxiii, 138 1927.

The results are given of manuring plots in hop gardens on two farms in Kent. Two complete manures, one containing dung, and one completely mineral, were used and compared with manures from which phosphate, nitrogen or potash was omitted. Unmanured plots served as "controls." The results on one farm showed that the omission of potash and of nitrogen, respectively, caused a great diminution in crop. On the other farm, nitrogen appeared to be the only manurial constituent deficient in the soil to any appreciable extent. No difference in the quality of the produce was found.

UNIVERSITY COLLEGE OF WALES, ABERYSTWYTH.

EVANS (R. E.). **Studies on Bog Hay.** *Welsh Journ. Agric.*, Vol. iii, 1927.

The botanical composition of the samples analysed shows a wide variation in the type of herbage forming so-called bog-hay, some being composed of one or two varieties, while others are composed of several types of vegetation. The chemical composition of these hays shows some types to be superior to others. Bog-hay cut early is superior in composition to that cut later, especially in mineral content.

The application of basic slag to bog-areas encourages the growth of a better type of herbage, wild white clover appearing to a small extent. The influence of phosphatic manures appears to be more pronounced on the mineral content of the hays than on the other constituents. Gafsa mineral phosphate is, on the whole, as suitable as the more soluble basic slags for bog-areas and has a more lasting effect.

The importance of good drainage on the effect of artificial manures is demonstrated.

A complete dressing of fertilisers gave a higher yield of hay from a bog-area than an incomplete dressing, the herbage being also superior in chemical composition. Sulphate of ammonia and kainit had less effect both on the yield and chemical composition of the natural herbage of peaty soil than basic slag.

Unmanured bog-hay is deficient in ash, phosphoric acid, lime and chlorine. The percentage of these constituents is considerably increased by artificial manures, especially basic slag.

FAGAN (T. W.). **A Shell Marl Deposit in Montgomeryshire.** *Welsh Journ. Agric.*, Vol. iii, 1927.

The bed situated immediately to the south-east of Castell Caereinion at an elevation of 600 feet above sea level is, so far as is known, the first of its kind found in the province of the University College of Wales. The alluvial deposits in which it occurs represent an old lake which was in existence in immediately post-glacial times and which has subsequently been silted up.

A generalised section through the deposits with their ranges of depths was as follows:—

Soil from 9 inches to 18 inches deep.
Grey blue clay from 6 inches to 18 inches deep.
Peat from 1 inch to 2 inches deep.
Shell Marl from 14 inches to 24 inches deep.
Grey blue clay about 16 inches deep.

The chemical composition of a series of samples of the Shell Marl taken along the length of the area from south-west to north-east is given.

UNIVERSITY COLLEGE OF NORTH WALES, BANGOR.

GETHIN JONES (G. H.). **Note on the Action of Hydrogen Peroxide on Farmyard Manure in Different Stages of Decomposition.** *Journ. Agric. Science*, xvii, p. 104. 1927.

The author has determined the "degree of humification" of farmyard manure in different stages of decomposition by estimating the proportion decomposed by 6 per cent. hydrogen peroxide. The degree of humification depends on the amount of litter present and the extent to which it has rotted. In the best rotted samples the humification amounted to 74·5 per cent.

GETHIN JONES (G. H.). **Preliminary Soil Survey of the Creuddyn Peninsula.** *Welsh Journ. Agric.*, Vol. iii, p. 154. 1927.

A preliminary survey of an area of Caernarvonshire in which the soils are derived from Palaeozoic Rocks and their associated drifts.

ROBINSON (G. W.) & JONES (J. O.). **Losses of Added Phosphate by Leaching from N. Welsh Soils.** *Journ. Agric. Science*, xvii, p. 94. 1927.

Under extreme humid conditions obtaining in N. Wales, with soils showing a high degree of base unsaturation, phosphoric acid added to grassland as basic slag is fugitive in its effect. The disappearance of the effect of slag dressings which takes place in about six years is shown to be reflected in the removal of the added phosphate from the surface layers of the soil.

EDINBURGH AND EAST OF SCOTLAND COLLEGE OF AGRICULTURE.

CAMERON (A. M.) & DOW (W. T.). **The Application of Ridsdale's Modification of Pemberton's Method for the Volumetric Determination of Phosphoric Anhydride to Fertilisers.** *Analyst*, lii. 576–580, 1927.

The Ridsdale's Modification of Pemberton's Method for the estimation of phosphoric anhydride in slag, iron, and steel is applied to fertilisers for the determination of water soluble, citric soluble and total phosphate. The method consists in the precipitation of the phosphate as ammonium phosphomolybdate and the subsequent solution of the precipitate in standard alkali and titration of the excess of alkali with standard acid. The chief modifications are as follows:—

(*a*) Neutralisation of the solution by sodium hydroxide before acidification to constant strength prior to precipitation.

(*b*) The use of the Leffmann-Beam Centrifuge for dealing with the precipitate. This avoids the filtration of more than a small amount of the bulky precipitate dealt with.

OGG (W. G.). **Report of Excursion across the Soil Zones of Hungary.** *Scottish Geographical Mag.*, xliii. July, 1927.

The writer was sent as an official delegate to a meeting of the Committee engaged in preparing the Soil Map of Europe. For the purpose of comparing methods and of endeavouring to secure uniformity in the production of the maps from the various countries meetings were held in Hungary and an excursion arranged at which the delegates from the different countries were able to see a wide range of soils.

In the report a short account is given of the development of knowledge of soil classification and methods of soil surveying. An account is also given of the soil zones of Hungary and the methods adopted there.

In conclusion a statement is made of the groups of soil proposed to be shown in the European Map which has since been published.

NORTH OF SCOTLAND COLLEGE OF AGRICULTURE.

HENDRICK (J.) & NEWLANDS (G.). **Scottish Drift Soil. IV. Exchangeable bases.** *Journ. Agric. Science.* 1926. xvi. pp. 584–595.

Data are given for the exchangeable base content of a Scottish drift soil. The presence of silicon, aluminium, iron, and manganese is noted in the extracts in addition to calcium, magnesium, potassium, and sodium. The relative proportions of the different exchangeable bases are: calcium, 85·02 per cent.; magnesium, 8·11 per cent.; potassium, 2·18 per cent.; sodium, 4·68 per cent. The results are in agreement with those generally found for acid soils.

HENDRICK (J.). **Loss of Nitrates from Cropped Soils.** *Agric. Prog.*, 1925, ii, 69–71; *Chem. Abstr.*, 1926, xx, 3056.

Crops appear to take up nitrates practically as fast as they are formed from the nitrogenous fertilisers applied, since no appreciable loss was observed, even in very wet weather. Drainage waters from unmopped soils contained 3–7 times as much nitrogen as those from cropped soils.

HENDRICK (J.) & NEWLANDS (G.). **The Mineral Composition of the Soil as a factor in soil classification.** *Abstracts of Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C. U.S.A., June, 1927. J. Heidingsfeld Co., New Brunswick, N.J.

The method for mineralogical examination is described and results obtained for certain English and Scottish soils outlined. Compared with well-known English soils such as that from Rothamsted Experimental Station, Scottish soils generally showed higher content of mineral silicates with reserve of bases. Scottish soils could be differentiated according to the kinds and amounts of minerals present. Classified thus, soils whose parent materials were of similar origin and nature were grouped together. The distribution of the soils showed that in those arising from glacial deposits the mineral composition is frequently determined by the solid rock underlying, or in the immediate neighbourhood.

HENDRICK (J.). **The Evolution of the Fertiliser Industry.** *Trans. Highland & Agric. Soc., Scotland.* 5th Series xxxix, 1925. pp. 78–96.

Deals with the rapid expansion during the present century of the fertiliser industry as a world industry and the recent tendency to the concentration of manufacture in the hands of a few large and powerful firms such as the I. G. Farben Industrie A.G. in Germany and Imperial Chemical Industries,

Ltd., and its subsidiary Companies in Britain. The necessity for continuous fertiliser research to enable this country to maintain its position is insisted upon.

HENDRICK (J.) & WELSH (H. D.). **The Substances removed by the Drainage from a Scottish Soil.** *Proc. 1st Intern. Congress Soil Sci.*, Washington. June, 1927.

Lysimeter investigations were conducted for several years upon three plots of undisturbed soil 40 inches deep under rotation cropping; one unmanured, another manured with dung and artificials and the third manured similarly and with lime in addition. Nitrogen loss in drainage is shown to be small, even when nitrogenous manures are applied. Soda found almost equal in amount to lime. Magnesia considerable: Potash in larger quantity than generally recorded elsewhere. Acid radicles always present in considerable amount: phosphates present in traces only. It is notable that while carbonate is practically absent from the drainage silicate is plentiful.

HENDRICK (J.) **Notes on the conditions of Nitrification.** *Proc. 1st Intern. Congress Soil Sci.*, Washington. June, 1927.

The drainage experiments at Aberdeen show that nitrification takes place freely in soils free from carbonate of lime, even when the acidity is as great as pH 5·0, and when manurial substances such as sulphate of ammonia are applied in excessively large dressings. It was also found that the application of manures increased the natural processes of decomposition of organic matter and production of nitrate in the soil.

NEWLANDS (G.). **Scottish soil types with special reference to North-east Scotland.** *Abstracts of Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C. U.S.A., June, 1927. J. Heidingsfeld Co., New Brunswick, N.J.

A typical example of the succession of horizons developed in a normal area of virgin soil under the climatic conditions of north-east Scotland is given. Factors modifying the normal succession are discussed under the headings of topography, geology, glaciation, climate, vegetation and cultivation.

MINISTRY OF AGRICULTURE FOR NORTHERN IRELAND.

ROBERTSON (G. S.). **Experiments in Northern Ireland with various Phosphates.** *Journ. Min. Agric., N. Ireland.* Vol. I.

This paper gives the results of a series of field experiments carried out in the six counties of Northern Ireland over a period of five years on the turnip and potato crops and on a rotation of crops with the object of (1) comparing the value of various types of rock phosphates, superphosphate, high grade basic slag, Semsol (a mixture of equal parts of rock phosphate and superphosphate) and a synthetic silica phosphate of lime; (2) ascertaining whether finer grinding beyond the usual standards of 80 per cent. through the 100 mesh sieve increased the efficiency of rock phosphates. The results show that in the turnip crop there is little difference in the relative value of the types of phosphatic fertilizers mentioned but that for potatoes the water soluble phosphate in superphosphate is worth twice as much per unit of phosphoric acid as the phosphoric acid in any of the other phosphatic fertilizers tried.

The influence of soil and climatic conditions is discussed and it is shown that the differences due to variations in these two factors are relatively small and unimportant. In a very wet season better results are obtained from superphosphate than from any of the other types of phosphatic fertilisers. The results recorded for the potato crop show that finer grinding up to the standard of the "180" mesh sieve is not likely to increase the efficiency of rock phosphates by more than 10 per cent.

(2) PLANT PHYSIOLOGY

(including Horticultural and Glasshouse Crops).

EXPERIMENTAL AND RESEARCH STATION, CHESHUNT.

OWEN (O. V., SMALL T.) & WILLIAMS (P. H.). **Carbon di-oxide in relation to glasshouse crops. Pt. III. The effect of enriched atmospheres on tomatoes and cucumbers.** *Ann. App. Bio.* 1926., xiii, pp. 560–576.

Whilst the rate of germination of tomato seeds is unaffected by the presence of increased concentrations of carbon dioxide, exposure of the growing plants to an average concentration of 0·6 per cent. for 1 or 2 hours daily causes an increase of over 20 per cent. in marketable crop. Cucumbers treated with 0·9 per cent. for 1 hour daily show an increase of 16 per cent. in crop.

The increase in the tomato crop appears to be accompanied by an increased susceptibility to infection by *Collectotrichum atramentarium*. Unsatisfactory attempts to use a "commercial" apparatus for supplying carbon dioxide in glasshouses are described and discussed.

HORTICULTURAL RESEARCH STATION, EAST MALLING, KENT.

GRUBB (N. H.). **Experiments with Double-Worked Pears on Quince Stocks.** *Ann. Report. East Malling Res. Station* (Thirteenth Year), ii. Supplement. Mar., 1927.

Experiments with double-worked pears on quince stocks have shown:—

That Souvenir du Congres and Beurre Clairgeau are clearly unsatisfactory within three years from planting, when worked direct on quince stocks (Angers). Dr. Jules Guyot and Marie Louise, while none too good, are less clearly unsatisfactory at the same age.

That the variety used as intermediate in double-working has a distinct influence on the vigour of the second scion. The results are shown in tabular form.

That this influence of the intermediate on vigour is not always directly correlated with the vigour of the variety used as intermediate.

That the variety used as intermediate probably has an influence on the age at which the tree begins to bear fruit.

HATTON (R. G.). **The Influence of Different Root Stocks upon the Vigour and Productivity of the Variety Budded or Grafted thereon.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 1. Feb., 1927.

The conclusions to date are summarised to show that it is possible to distinguish botanically and raise vegetatively fruit tree root stocks, and so eliminate seedling variability. Experiments designed to test the influence of these different root stocks upon the variety worked thereon are described.

Some discussion follows upon :—

The problem of the best size for the experimental unit and its distribution.

The repetition of the experiment in successive seasons upon different soils, and with different scion varieties.

The sixteen varieties of root stock under trial are then briefly described.

Records designed to give a complete measure of the trees' vigour and productivity are detailed, and the figures for seven and eight year old trees giving measurements of wood growth, girth, height, spread and fruit production, are presented.

These figures show that a single variety of apple budded upon four distinct varieties of root stock behaves very differently upon each, both in the amount of wood growth it makes and fruit it produces. On one root stock it may make five times the wood growth that it does upon another; or, again, it may fruit ten times as heavily.

The significance of these differences is discussed. Between the four significantly different stages, an almost continuous gradation of vigour and cropping is found upon other stocks.

The generally accepted antagonism between wood-growth and fruiting is discussed, and exceptional cases cited.

It is shown that trees may appear identical in size and form, yet may be widely apart in cropping performance.

The productivity of the trees is examined both in relation to the space occupied by the tree and the age at which it comes into bearing.

The percentage of flowers which set and form fruit has differed consistently upon different root stocks, so has the position of the fruit buds on the tree.

The amount of variability between trees upon the same root stock is illustrated, and the causes discussed. These differences are partly due to soil differences and the biennial bearing habit of trees, and might be even further reduced.

The general results are confirmed upon the supplementary plots on very different soils, the *actual* performance of the trees on any particular stock differing much from soil to soil, but the *relative* performance remaining the same.

It is claimed that a much greater control has been established over the tree than heretofore, as a result of a more precise knowledge of the influence of root stock.

From the point of view of horticultural experimenters it opens up the possibility of using much more uniform material for field work. It is now possible to gauge its variability and determine more accurately the essential lay out of such experiments, with, consequently, greater hope of obtaining more significant results.

From the fruit growers' point of view the economic value of trees of known capabilities for size and cropping is demonstrated.

HATTON (R. G.) & AMOS (J.). **Experiments upon the Removal of Lateral Growths on young apple trees in summer.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 1. Feb., 1927.

The "defeathering" in summer of the stems of young trees has been shown to affect the tree's weight and girth adversely.

This "defeathering" also much restricts the development of the tree's roots.

On the other hand, it seems clear that the remaining leader growths are not very materially strengthened.

Generally, trees allowed to feather in the nursery, show some slight gain in growth the year after transplanting.

These facts have a practical application both in the raising of young trees, and summer pinching practices. They also shed some light on theoretical considerations of the root shoot ratio.

HATTON (R. G.). **Characteristics and Suitability of the so-called "Paradise" Stocks.** *Ann. Rept. East Malling Res. Station*, A8. p. 47.

The origin and principal characteristics of the first 16 varieties of layered rootstocks isolated and described at East Malling are given. The extent and nature of the mixture of commercial rootstocks are indicated.

HATTON (R. G.). **Memorandum upon the Standardization of Horticultural Material by Selection and Vegetative Propagation with special reference to Rootstock Influence.** *Empire Marketing Board.* May, 1927.

Since the reproduction of fruit plants from seed is very generally impossible owing to the resulting variability of the progeny, vegetative methods of propagation have been resorted to.

Suitable methods of vegetative propagation are found to differ not only with different species, but with different varieties, and varying soil and climatic conditions.

Despite the use of these methods, considerable variation in performance of individuals of the same variety has persisted.

In the case of plants grown upon their own roots, this variability has been proved to be due to such causes as:—

(*a*) Mixed and misnamed strains.
(*b*) The occurrence of "sports" and "rogues" from seed.
(*c*) Source of origin, involving methods of propagation employed and environmental conditions during raising.

The application of methods of selection and "trap-nesting" is recommended as having proved successful for the re-establishment of more profitable lines.

In the case of plants grafted (or budded) upon a foreign root-stock, this variability has been shown to be largely due to the influence of the root upon the scion.

The diverse character of seedling roots has been largely responsible for the variations in growth, yield, anchorage and even disease resistance within a single variety,

This variability can be greatly reduced by applying methods of vegetative propagation far more generally in the raising of the root-stocks used.

These methods have been successfully applied to a range of selected root-stocks for apples, pears, plums, peaches and cherries, and the principle is recommended for consideration in the case of other plants exhibiting similar variability.

The application of these principles has resulted in a much greater control of the tree for the grower, who can measure its potentialities far more accurately. It also means a larger and often a quicker output of saleable trees for the tree raiser.

The advantages of standardising the fruit-grower's material by guaranteeing the desirable "build-up" of his trees are of great economic importance.

Unprofitable trees and bushes can to a great extent be eliminated and a much higher standard of attainment assured.

Experimenters can be assured of much more uniform material with greater reliability and confidence in the results.

KNIGHT (R. C.). **Preliminary Observations on the Causes of Stock Influence in Apples.** *Ann. Report East Malling Res. Station* (Thirteenth Year), ii, Supplement. Mar., 1927.

Three years' results are recorded from preliminary experiments designed as a first analysis, by field methods, of the nature of stock influence.

A "double-working" experiment, using stems of stocks as intermediate scions, indicates that the stem as well as the root system of a rootstock may play a considerable part in influencing the scion.

The behaviour of "multiple-budded" and "double-stock" trees in their early years suggests that purely quantitative differences between stocks play a part in producing scion differences.

The vegetative union of a scion with two stocks of different character produces a tree the vigour of which is intermediate in type. The factors coming from the stock which govern blossom formation do not appear to be evenly blended.

KNIGHT (R. C.). **Observations on the Water Conductivity of the Stems of Reverted Black Currants.** *Ann. Report East Malling Res. Station* (Thirteenth Year), ii, Supplement. Mar., 1927.

No significant difference was observed between the conductivity of stems of reverted plants and that of normal stems.

Rogers (W. S.). **Root-Stock Effect on Colour and Size of Apples, (with Appendix describing Details of Experimental Colour Grading).** *Ann. Report, East Malling Res. Station* (Thirteenth Year), ii, Supplement. Mar., 1927.

Section 1. Figures are here presented showing the effect of stock on colour of apples of three varieties—for two years in the case of one variety, and for one year in the case of the other two varieties—on three different soils. It is shown that the very dwarfing stock Type IX has usually produced most colour on the fruits, but Type II has tended to give less colour than the more vigorous Type I. There are indications that there may be considerable variation between the colouring effect of different very vigorous stocks.

Section 2. Figures are given showing the effect of stock on size of apples of two varieties, for two years in one case, and for three years in the other. It appears that Type IX gives the largest fruits in some years, but fluctuates considerably. Type I has given larger fruits than Type II.

Section 3. Details are given of the experimental methods used in grading for size and colour, and various methods of working out the results are discussed.

It is noted that the colour of apples may increase considerably after picking, and an example is given of actual increase observed in three weeks.

RESEARCH INSTITUTE IN PLANT PHYSIOLOGY, IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, LONDON.

Blackman (V. H.). **Sunlight, the Plant, and Light Efficiency.** *Year Book, Essex Farmers' Union.* 1927.

This paper gives an account in semi-popular form of the plant as a machine for utilising the energy of the sun. It is pointed out that a cereal or clover crop employs in the manufacture of plant material only 1 to 3 per cent. of the energy of the sun which reaches the ground. This low efficiency is largely due to the low concentration of raw material, i.e., carbon dioxide, available for the process of food manufacture. With high concentrations of carbon dioxide and weak light the plant may work with an efficiency of nearly 60 per cent.

Blackman (V. H.). **The Effect of Radiation on Plant Growth.** *Journ. Min. Agric.*, Vol. xxxii, No. 9. Dec., 1926.

This paper, which was read in 1926 before a Conference of Agricultural Meteorological Observers, reviews very briefly the relationship of radiation to the growth and assimilation of plants.

Brown (J. W.). **Chemical Studies in the Physiology of Apples. vi. Correlation in the Individual Apple between the Mineral Constituents and other Properties.** *Ann. Bot*, xli, pp. 127-137. 1927.

This paper is a continuation of an earlier paper by the same author published in Vol. xl, 1926, of the same journal. It is shown that low values for the hydrogen-ion concentration of the juice are associated with high total ash and high potash content. Significant correlations are also found between potash and phosphate, phosphate and acidity, and phosphate and iron. Potash and iron, and potash and acidity, are inversely correlated.

Knight (R. C.). **The Propagation of Fruit Trees Stocks by Stem Cuttings. I. Observations on the Factors Governing the Rooting of Hardwood Cuttings.** *Journ. Pom. & Hort. Sci.*, Vol. v, No. 4. Oct., 1926.

Trials of several varieties of hardwood cuttings under different soil conditions showed that the amount of callus formation is not necessarily indicative of the amount of root formation.

Callus formation and root production are two distinct processes bearing no consequential relation to each other, but are collateral manifestations of internal conditions, and the relation between them is very susceptible to external circumstances.

Callus formation is favoured by high water content of the soil and heavy rainfall, whilst root production appears to be favoured by a lower water-content with which is correlated efficient aeration.

Callus formation in a light sandy soil can be greatly increased by constant artificial watering.

With the varieties used, no constant effect, similar to that obtained by Curtis, with Ligustrum and tomato, has been observed by treatment with potassium permanganate, boric acid, and phenol ; potassium nitrate decreased root formation.

Cane sugar, when introduced into a cutting has a definite effect upon rooting, and the effect varies with the concentration and with the duration of the treatment. Further, the effect varies from season to season, but the factors causing this variation have not been determined.

When cuttings prior to planting are placed with their bases in solutions of cane sugar, there is no selective absorption, and the concentration of the solutions remains unchanged, although the volume absorbed varies inversely with the concentration. The sugar so absorbed rapidly accumulates in the leaves.

KNIGHT (R. C.) & WITT (A. W.). **The Propagation of Fruit Tree Stocks by Stem Cuttings. II. Trials with Hard-and Soft-Wood Cuttings.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 1. Feb., 1927.

Details are given of the results obtained from trials of hard- and soft-wood cuttings of varieties of apple, plum and cherry.

With soft-wood cuttings the greatest success has been obtained with stems not in active growth planted early in the year.

In general, sand was found to be the most suitable substratum, although there are indications that other materials are more suitable for some varieties.

Stems with etiolated bases rooted more readily than normal green cuttings.

KNIGHT (R. C.). **The Relation in the Apple Between the Development of Young Shoots and the Thickening of Older Stems.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 1. Feb., 1927. (Reprinted *East Malling Res. Station Ann. Report.* Thirteenth Year. II. Supplement 1927.)

In spring new wood formation in the stem of the apple begins in close proximity to a developing shoot and spreads vertically downwards. Upward and lateral spread of such thickening occurs only later.

These facts throw light on the growth responses to certain pruning operations.

MASKELL (E. J.). **Field Observations on Starch Production in the Leaves of the Potato.** *Ann. Bot.*, xli, pp. 236–44, 1927.

The rate of starch formation in the leaves of plants growing under natural conditions in the field was followed (during the later period of growth) in plants given respectively no potash, potassium sulphate, potassium chloride and "potash manure salts." Sachs' iodine test was employed and the amount of starch formed was determined by comparing the treated leaf with a standard scale of colour tones (Ridgway's). The results were analysed statistically. Potassium sulphate was found to increase the rate of starch translocation and also of starch production. Potassium chloride had no effect.

MIDDLETON (N. I.). **The Effect of Ionised Air on the Rate of Respiration of Barley Seedlings.** *Ann. Bot.* xli, pp. 345–56, 1927.

This work was undertaken in an attempt to elucidate the effect of electric discharges on the growth of plants. The air passing over barley seedlings was artificially ionised by means of polonium which throws off alpha particles. With an ionisation so produced, 20,000 times that of normal air (assumed to be 500 positive and 500 negative ions per c.c.), an increase in the rate of respiration during the hour of application was observed of $29{\cdot}1 \pm 5{\cdot}6$. The nature of the effect is at present obscure. It is almost certainly due to the action of the ions themselves and not to the small amount of gaseous products associated with such ionisation.

WHIMSTER (K.). **The Effect of Ionised Air on the Assimilation and Respiration of Green Leaves.** *Ann. Bot.* xli, pp. 357–74. 1927.

This is a companion piece of work to that of Middleton abstracted above. Air was ionised in the same way but in this case leaves of *Pelargonium zonale* were exposed to such air. The leaf and the polonium were in a closed system and the change in carbon dioxide content was estimated by the use of brown-cresol-purple as an indicator. No effect on the rate of *apparent* assimilation was demonstrable but there was a remarkable effect on the rate of respiration which showed a percentage increase of $85{\cdot}7 \pm 7{\cdot}1$ at 25°C. This direct effect is followed by a smaller "after-effect" during the succeeding two hours.

LONG ASHTON FRUIT RESEARCH STATION.

BALL (E.). **The Time of Differentiation and the subsequent development of the Blossom Bud of the Plum.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 3, September, 1927.

A brief survey of the work which has been carried out in America and elsewhere on the time of differentiation of blossom buds of some of the cultivated fruits is given.

In the present investigation, which was concerned with observations made during the years 1924 and 1925, the commencement of the formation and the development of the blossom buds of the three varieties of plum, Victoria, Monarch and Pond's Seedling, were traced. In both seasons it was found that the earliest signs of blossom bud differentiation could be seen in the period mid-July to early August. In 1925 differentiation took place at a rather earlier date than in 1924. The buds of the variety Victoria, whether taken from a vigorous tree or from a dwarf tree passed through the early stages of differentiation more rapidly than did those of the other two varieties. The buds of all three varieties reached the same stage by November, when all the flower parts, sepals, petals, stamens and pistil were present. The ovules and pollen grains were not usually formed until January or February.

BALL (E.). & MANN (C. E. T.). **Studies in the Root and Shoot Development of the Strawberry. II. Normal Development in the Second Year.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 2, June, 1927.

Observations on the normal growth of the strawberry plant and on the effect of various factors on this, the commencement of the description of which can be found in a previous communication to the same Journal, are further described. The second year of the plant's life is fully described and illustrated with photographs. The sequence of events described in the first season's growth was closely followed, viz., vigorous growth of main roots and daughter crowns in the late summer and autumn followed by dormancy from

December until March. In the spring fairly considerable growth of secondary and tertiary roots (fine roots) took place; the bulk of the primary or main roots formed in the previous autumn remained almost completely unfurnished with fine roots until the spring. From March until Midsummer there was a vigorous growth of leaves, flowers and fruit but little root growth. A point of interest was that no death of primary roots but only of secondary and tertiary roots was recorded during the 26 months during which the plants were kept under observation.

BALL (E.) & MANN (C. E. T.). **Studies in the Root and Shoot Development of the Strawberry. III. The Influence of time of Planting on the Development of the Strawberry with a consideration of the possible influence of Soil and Locality.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 2, June, 1927.

Observations on the effect of varying the time of planting strawberry runners are fully described. The runners were planted at various dates from early August until mid-December, and also in the spring, and observations made at intervals on the growth of roots, crowns, foliage and flowers. In the first season it was evident that the earlier the planting had been carried out the more vigorous were the plants, those planted in August being outstandingly the best developed plants. These results were borne out in two consecutive seasons. After cropping there was a marked levelling up of the vigour of the plants of all the series. If a crop is desired in the first season the earlier the runners are planted the better, but it is pointed out that local conditions of soil and weather must be taken into consideration.

Plants growing under different conditions of soil and climate in Norfolk were kept under observation concurrently with those growing at Long Ashton. The annual sequence of growth was seen to be the same at both places. The conclusion was reached that only slight variation in the time of initiation or termination of a phase of growth, or in the volume or nature of root or shoot formed, would occur.

BALL (E.) & MANN (C. E. T.). **Studies in the Root and Shoot Development of the Strawberry. IV. The Influence of some Cultural Practices on the normal development of the Strawberry Plant.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 2, June, 1927.

The effects of various factors on the growth of the strawberry plant are described, viz., methods of planting, cultural treatments; the cause of the production of some forms of strawberry "small-leaf" are given as follows:— (1) Exposure of crowns; (2) Waterlogging; (3) Damage to the roots, and (4) Damage to the crowns.

In addition the distribution of the roots of strawberry plants in the soil was investigated. It was found to be a markedly surface rooting plant, 73 per cent. of the roots being found in the top three inches of soil.

In each article the practical significance of the observations made is discussed.

BALL (E.), MANN (C. E. T.) & STANILAND (L. N.). **Strawberry investigations at Long Ashton. I.** *Journ. Min. Agric.*, Vol. xxxiv, No. 6, September, 1927.

Some investigations carried out at Long Ashton from September, 1924, until the winter of 1926 are fully described. In this first section a detailed description of the growth of a normal healthy strawberry plant and of the effect of certain factors, viz., time of planting, methods of planting and

cultural treatments, on the normal growth, is given. The season for root and shoot growth and the effect of variation of locality on this are described.

The important points relating to the normal growth which were revealed were: (1) The bulk of the root growth takes place mainly in the late summer and autumn. (2) Roots formed during this period are strong main roots arising from between the lower leaf bases. This root growth can be encouraged by maintaining close contact between soil and crown. (3) Large numbers of fine feeding roots arise during the spring on these main roots and from the essential absorbing organs of the plant during the flowering and cropping season. (4) The strawberry is shown to be a markedly surface rooting plant.

Enormous advantage was gained at Long Ashton by early planting, and if a crop is desired in the season following planting it is recommended that runners should be planted at the earliest possible date compatible with local conditions. Various causes of the production of strawberry "small-leaf" are given, e.g., waterlogging, damage to roots or crowns, and exposure of the crowns by careless cultivation.

LEES (A. H.). **Factors Governing Fruit Bud Formation. VII. Influence of Summer Rainfall and Previous Crop on Fruiting of Apples.** *Ann. Rep. Agric. & Hort. Res. Sta.*, Long Ashton, 1926.

The writer's contention is that too much emphasis has been laid on the importance of the character of the weather at the flowering time of the apple and too little on the internal condition of the plant. The internal condition of the plant is of course influenced by many factors, but when in healthy trees the influences of stock, manuring, pruning, etc., are eliminated the two most important remaining factors are the previous summer rainfall and the previous crop. As evidence is cited the total rainfall figures for the months of June, July and August from 1853 to 1925, and cropping for the south-west of England from 1906 to 1925. It is shown that if the rainfall figures be classified into dry years (less than 6 in.), medium years (6–9 in.) and wet (above 9 in.), and these factors be combined with light, medium or heavy crops of the years in question, a table can be constructed forecasting probable crops.

In practice at Long Ashton the table has given fairly accurate forecasts, interfering factors being a previous bad attack of aphis, severe frost or uninterrupted cold weather over the flowering period.

Similar tables for Woburn give comparable results, but owing to the difficulty of the cropping being from young trees the forecasts are less accurate.

SWARBRICK (T.). **The Healing of Wounds in Woody Stems. II. Contributions to the Physiological Anatomy of Ringed Apple Shoots.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 1. Feb., 1927.

Two year old apple shoots were ringed at regular intervals throughout the year and were regularly examined from the view-point of histology and physiological anatomy. The following conclusions were drawn.

Ringing before the end of June results in double the amount of Xylem above the rings.

The effects upon stem anatomy depend upon time of ringing. Mid-June appears to be a critical period.

Knife-edge rings made in June heal over in a few days whereas ¼ inch rings do not often heal in the same year as they are made.

Ringing produces abnormal starch conditions above and below the rings. These may be associated with the observed growth responses produced by ringing.

The bearing of these observations upon commercial practice is discussed.

SWARBRICK (T.). **Studies in the Physiology of Fruit Trees. I. The Seasonal Starch Content and Cambial Activity in one- to five-year old Apple Branches.** *Journ. Pom. & Hort. Sci.*, Vol. vi, No. 2, June, 1927.

This study records a marked seasonal fluctuation in starch content of apple shoots. This fluctuation is definitely associated with well defined stages in the seasonal length growth and with diameter growth. Starch disappears from the tips of the shoots basipetally. Disappearance is complete during June from the younger branches but incomplete from the older branches and trunk. There is a relation between groups of spurs or laterals and these fluctuations in starch content in apple stems. Diameter growth begins later than elongation growth and continues later into autumn. The initiation and cessation of diameter growth show a marked basipetal order of development. There is a difference between the relative rates of starch disappearance and cambial activity in the vegetative and the flowering shoots. In vegetative shoots cambial activity is early and starch disappearance tends to lag behind, whereas in flowering shoots or spurs starch disappearance is early and cambial activity tends to lag. A discussion of these data is withheld until a further communication when data upon the effects of ringing upon this normal seasonal activity will be presented. The bearing of this knowledge of the fundamental physiology of tree growth will be discussed in this subsequent paper.

SWARBRICK (T.) & ROBERTS (R. H.). **The Relation of Scion Variety to the Character of Root Growth in Apple Trees.** *Wisconsin Agric. Exp. Stn. Research Bull.* 78, August, 1927.

It is shown in this work that under the conditions of American nursery practice of making root grafts, the scion variety has a marked influence upon the character and amount of root that is developed. Trees up to three years old were examined. Similarly it was found that scion varieties do not have the same marked influence upon the roots of vegetatively propagated root stocks. A tentative suggestion based upon the behaviour of double worked and high budded trees is offered. High budded trees do not have the characteristic root character of the root grafted trees. Double worked trees have a root (up to 3 years) characteristic of the intermediate scion. It is believed that the major effects of root stock influence are the result of the stem portion of the root stock rather than the actual absorbing root system as such.

(3) PLANT BREEDING, CROPS, SEEDS, WEEDS.

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY, CAMBRIDGE.

BEAVEN (E. S.). **Field Trials of Cereals.** *Journ. N.I.A.B.* No. 6. 1927.

This paper discusses in detail the crop improvement work of the Institute and the need for and value of reliable field trials. The Institute conducts such trials of new and old varieties in different parts of the country and arranges to distribute new ones of promise. These trials are necessary because a knowledge of the relative merits of varieties is essential to successful farming and no individual grower can test adequately for himself even the leading varieties, let alone the numerous new ones that appear yearly on the market. The Institute has already demonstrated that there are wide differences between the yield, or quality, or both, of different varieties, sometimes as much as 20 per cent. In Ireland and Denmark the average yields of barley have substantially increased in the past generation and Dr. Beaven gives reasons for attributing this improvement to the trials conducted in those countries for many years, and for hoping that the Institute's activities will in time confer similar advantages on English farmers.

BRETT (C. C.). **Common Parasites of Seeds.** *Min. Agric. Seed Analysts Bull.* No. 8.

After referring to the serious losses caused by insect pests and fungus diseases, the author explains how such pests and diseases are spread by seeds, describes the work done at the Seed Testing Station in identifying them, and discusses measures of control. He deals in detail with the following:— *Tilletia tritici; Ustilago hordei; Helminthosporium gramineum; Helminthosporium avenae; Claviceps purpurea; Phoma betae; Uromyces betae; Septoria apii; Ascochyta pisi;* Marsh spot of Peas; *Botrytis spp.; Coprinus lagopus; Calandra spp.; Bruchus spp.; Ceutorrhyncus assimilis; Oligotrophus alopecuri; Glyphipteryx fischeriella; Apion spp.; Aleurobius farinae;* and *Tylenchus scandeus;* and he states the extent to which they have been found in samples tested at the Seed Testing Station.

BRETT (C. C.). **Occurrence of Bunt in Wheat and Smut in Barley in Seed Samples received at the Official Testing Station in 1925-26.** *Min. Agric. Seed Analysts' Bull.* No. 9.

Gives the results of extensive microscopic examinations of wheat and barley samples in 1925–26. The author first describes his methods and then gives particulars of the percentage of samples of wheat showing different degrees of infection with *Tilletia triciti* (Bunt) and similar figures for *Ustilago hordei* (Smut) in barley. 400 samples of wheat were examined; 18 per cent. showed "naked-eye" indications, and microscopic examination showed that only 18 per cent. were entirely free from infection. Of 200 barley samples the corresponding percentages were 7·5 and 31.

EASTHAM (A.). **Ninth Annual Report of the Official Seed Testing Station for England and Wales.** *Journ. N.I.A.B.* No. 6. 1927.

This report covers the twelve months ended 31st July, 1926, when 22,884 samples, or 990 more than in the previous season and 261 more than the average of the previous seven seasons, were received for test. The majority came from seed firms, but 1,404 were from farmers, and 3,105 from public departments.

Several tables are given, showing the number of samples of different kinds of seeds tested, the number of samples received per month, the average germination of cereals, pulses, roots and vegetables and the average purity

and germination of grasses and clovers. The incidence of seed-borne diseases in cereals is dealt with in detail and the figures obtained for the last seven years illustrated by a graph. Another table shows the distribution of cereal samples according to variety, and suggests that Squareheads Master, Yeoman and Victor are the favourite wheats, Plumage Archer and Standwell the favourite barleys, and Abundance, Victory and Black Winter the leaders of the oats.

The accompanying text passes in review the character of the different classes of seeds during the season and explains the salient features of the tables.

A further 4,242 samples were tested for the purpose of special investigations, principally into the loss of vitality of seeds under different conditions of storage, but also into a number of other problems of practical importance to farmers, seed merchants and seed analysts.

The report concludes with copies of the papers set in the seed testing examination held at the Station in July, 1926.

ENGLEDOW (F. L.). **The Problem of Adaptation of Varieties.** *Journ. N.I.A.B.* No. 6. 1927.

Some varieties thrive better under one set of conditions, some under another. Each individual variety shows in some measure a special adaptation to certain conditions of soil, climate and cultivation. These facts present a problem of which the solution is still too much for physiological science. For the present, agriculturists must collaborate, for every character which distinguishes one variety from another is a small clue to the meaning and nature of adaptation.

National crop improvement mainly depends on the elimination of the worst varieties and the concentration of the best in localities most suited to them. The Institute's trials can do much to sort the varieties out, but practical application must be given to the knowledge so gained.

Quality, though less important in most crops than yield, affects considerably money value per acre, and therefore constitutes a separate problem of adaptation. It is concluded that for all crops an essential of progress is study of all the characters of all the varieties in relation to the circumstances of growing and marketing.

FINLAYSON (R. A.). **Identification of Certain Grass Seeds.** *Min. Agric. Seed Analysts' Bull.*, No. 8.

Describes preliminary work carried out at the Seed Testing Station with the purpose of confirming investigations by Mynher Hellbo of Copenhagen into ways of distinguishing seeds of *Lolium perenne* and *Lolium italicum*, and by Dr. Leendertz of Wageningen into ways of distinguishing seeds of *Festuca ovina* and its many forms from *Festuca rubra* and its varieties. The distinguishing features are dealt with at length, and the author is able to confirm Leendertz's work and to express the opinion that Hellbo's method will be found practicable.

PARKER (W. H.). **Trials of Autumn-sown Wheats, 1924-25.** *Journ. N.I.A.B.* No. 6. 1927.

These trials, the first of a three-year series, were laid out on the half drill strip system devised by Dr. E. S. Beaven, ten $\frac{1}{40}$ acre plots of each variety alternating with ten similar plots of the control (Squareheads Master in each case), at Cambridge, Norwich, Leegomery (Salop) and Long Sutton (Hants.). In trials conducted in this manner under normal conditions differences of 6 per cent. and over between varieties may be regarded as significant for the

place and year of trial. In these particular trials differences in excess of 4·6 per cent. were on the average significant.

The results are given, but no attempt can be made to draw definite conclusions after the first year of a three years' trial.

Milling and baking tests were carried out by Dr. A. E. Humphries and Robt. Hutchinson, appointed for the purpose by the National Association of British and Irish Millers, Ltd. They write at the end of a long report, printed in the Institute's Journal No. 6:—

"For bread-making purposes the Yeomans remain in a class by themselves, among forms usually grown in England. Small differences in quality have been disclosed between the other forms tested, and, dealing with relatively small points, some of the results are surprising. For instance, Wilhelmina proves to have been in 1925 relatively strong, Little Joss relatively weak, and Iron III better than its appearance and reputation would have led us to expect. Fox is good of its class, Cambridge Browick is, all points considered, poor. Gluten content again proves to be unreliable as an index of quality measured by usual English methods of bread manufacture."

PARKER (W. H.). **Trials of Spring Sown Oats, 1925.** *Journ. N.I.A.B.* No. 6. 1927.

The stations and method of trial were the same as those described in the above summary.

PARKER (W. H.). **Trials of Spring Sown Barleys, 1925.** *Journ. N.I.A.B.* No. 6. 1927.

For stations and methods see above Summaries. The order of ripening and yields of grain are given.

Valuations, analyses and malting tests of the produce were made by the Institute of Brewing. They revealed that the differences between station and station were much greater than between variety and variety; *i.e.*, quality appeared to be dependent more on environmental than on varietal factors. Plumage Archer 1924 was almost without exception superior to the other varieties at all stations.

Combining the yield and quality results, Plumage Archer 1924 headed the list, followed closely by Spratt-Archer, Archer and Sunrise in that order.

PARKER (W. H.). **Trials of Mangolds, 1925.** *Journ. N.I.A.B.* No. 6. 1927.

These, with the swede trials described in the Summary below were the first root trials carried out by the Institute, and were primarily intended to evolve a satisfactory method of test. It was found that by having four plots consisting of four drills and $\frac{1}{40}$ acre in area of the "variety" alternating with five similar plots of the control, eight $\frac{1}{40}$ acre plots of each were available for comparison, and differences exceeding 6·33 per cent. could on the average be regarded as significant.

As the result of these trials it was decided (1) to use Yellow Globe as the control type in the future, (2) to use the same method of test, but to halve the number and double the length of the drills.

PARKER (W. H.). **Trials of Swedes, 1925.** *Journ. N.I.A.B.* No. 6. 1927.

The remarks made about the Mangold trials summary above apply in general to these trials. The Round Purple Top type (*e.g.*, Best of All) was

used as control to four of the other main types and a new variety, Smith's Green Top. On the average the standard of accuracy was about the same as in the Mangold trials.

The relative yields of roots, dry matter and sugar are given.

PARKER (W. H.). **Maturity and Yield Trials of Main Crop Potatoes, 1925.** *Journ. N.I.A.B.* No. 6. 1927.

These are the first year's results from a three years' series of trials of the leading main crop varieties of potatoes, both those immune and those susceptible to wart disease, carried out at the Institute's Potato Testing Station, Ormskirk (where only immunes can be grown), Kirton, near Boston, Lincs., and Truro, Cornwall. The time taken to mature and the total yields are given.

There were indications of negative correlation between early maturity and high yield. The yield of "ware" tubers was in general proportional to the total yield. The report also deals in detail with the incidence of disease. General conclusions are deferred until the three years' trials are completed.

PLANT BREEDING INSTITUTE, CAMBRIDGE.

BIFFEN (R. H.). **Wheat Production in Kenya Colony.** *Nairobi*, 1927.

Amongst other matters the paper deals with the distribution of *Puccinia graminis*, *P. triticina* and *P. glumarum* in the Colony and the progress which has been made towards the production of rust-resisting varieties.

WATKINS (A. E.). **Genetic and Cytological Studies in Wheat. III.** *Journ. Gen.*, xviii, 375–396.

Investigation of species crosses is continued. The genetic basis of bad grain germination in such crosses is worked out. Association of certain characters with chromosome number is studied with particular reference to sterility in the pollen of the F_1.

WELSH PLANT BREEDING STATION, ABERYSTWYTH.

JONES (E. T.). **Preliminary Studies on the Absence of Yellow Colour in Fatuoid or False Wild Oats.** *Welsh Journ. Agric.*, Vol. iii, p. 221. Jan. 1927.

This paper deals with F_1, F_2 and F_3 generations of direct and reciprocal crosses between the variety Golden Rain (*A. sativa* L.) and a selected fatuoid plant with "non-yellow" grain, which was suspected of being of Golden Rain origin. Two pairs of contrasting characters were studied, namely, yellow and non-yellow *colour* of grain, and fatuoid and non-fatuoid (=*sativa*) *type* of grain. The F_1's were intermediate in type of grain, but resembled the fatuoid parent in being non-yellow in colour. In the F_2 generation only the parental and F_1 types were obtained, namely, yellow *sativa*, non-yellow intermediates (=like the F_1's) and non-yellow fatuoids, and of these there were 21, 44 and 25 respectively. No segregation occurred for the colour of the grain. In F_3 the yellow *sativa* types all bred true and the non-yellow intermediates repeated the type of segregation exhibited by the F_2. Investigation in the field of the segregating families showed that amongst the panicles bearing fatuoid grain those well and fully matured had non-yellow grain, whereas the grain of the less matured fatuoid panicles was greenish-yellow in colour. These latter on maturity or when air dried became, with certain

exceptions, non-yellow like the original fatuoid plant. The negative correlation between the fatuoid complex and yellow colour of grain appears to be due to the loss of, or to failure to produce, yellow colour in the matured grain when this is homo- or hetero-zygous for the fatuoid characters. Both parents were apparently homozygous for the yellow colour factor, but the yellow colour was finally fully expressed only in the complete absence of the fatuoid characters. The absence of yellow-*fatua* segregates in F_2 and subsequent generations has formerly been held to be due to an inhibitory action of the factor for yellow, or of a factor associated with it, upon the development of the *fatua* characters. The above data offer a converse interpretation.

JONES (G.) & TINCKER (M. A. H.). **Yield Studies in Oats. The Effect of the Pre-treatment of the parent Crop upon the Seed Produced, its Germination and Subsequent Growth.** *Ann. App. Bio.*, Vol. xiii, No. 4, p. 535. Nov. 1926.

At high elevations the number of spikelets per panicle on Record oats was greater than at low elevations; the number of grains per spikelet and the average size of the grain were small at high elevations.

Drastic winnowing caused an improvement in the germination of hill grown seed. When spaced plants were grown from grain of a hill and lowland sample, selected to be equal in weight, the differences observed between the two series were small.

The date of sowing of the parent crop was found to influence the quality of the seed produced. The earlier and later sown parent crops produced seed which did not yield so well as normal samples both in row trials, and in a series of growth tests, which indicated that seed samples from crops sown at abnormal dates were particularly sensitive to moisture conditions adverse to germination and early growth.

HORTICULTURAL RESEARCH STATION, EAST MALLING.

SALMON (E. S.). **Tenth Report on the Trial of New Varieties of Hops, 1926.** Aug., 1927.

Of the 112 varieties (new and commercial) tested, one new variety cropped at the rate of 32¾ cwt. to the acre, and no less than 74 at the rate of 20 cwt. or over to the acre.

The number of bushels (Imperial) of green hops required to the cwt. of dried hops varied in the new varieties from 84 to 126, and in the commercial varieties from 92 to 121.

In all classes (early, midseason and late varieties) the judges preferred certain commercial varieties (viz., the Bramling, Rodmersham and Canterbury Golding) to any of the new varieties.

In all the classes (early, midseason and late varieties) certain new varieties proved, when analysed by the new Ford and Tait method, to be richer in preservative qualities than any of the commercial varieties tested. One new late variety (OT31) was richer in preservative qualities by 2·25 per cent., than the richest commercial variety tested.

Two new varieties were richer in preservative qualities than the richest sample of American hops obtainable:—OT31 by 1·13 per cent. and OF27 by 0·25 per cent.

Three new varieties (OF27, M45, OP21) have given excellent results in recent brewing trials. The main characteristics are given of these varieties, as observed over a period of from five to nine years.

Notes are given on the incidence of "mosaic disease" and "Downy mildew."

UNIVERSITY OF BRISTOL AND LONG ASHTON FRUIT RESEARCH STATION.

BALL (E.). **The Correlation between some characters of Progeny and Parent in the Strawberry.** *Ann. Rep. Agric. & Hort. Res. Sta.*, 1926.

An account is given of some work which involved the detailed observation of some strawberry plants which had been selected as parents and also of their progeny. The characters under observation in parent and progeny were: (1) differences in vigour; (2) differences in the proportion of blossom to foliage; (3) "blindness" or absence of blossom.

A correlation was found between the vigour of the parent plant with that of its progeny. The vigour of the progeny was found to be increased by restricting the number of runners formed, *i.e.* allowing only four first runners in the one case and an unlimited number of runners in the other. No correlation between the proportion of blossom to foliage in parent plants and that in their progeny was apparent; such differences in habit probably being due to environment. The importance of the selection for propagation of vigorous healthy parent plants is pointed out.

HUTCHINSON (H. P.). **Investigations on Willow Culture and the Utilisation of Basket Willows.** (Progress Report.) *Bath & West Journ.* 1926–27.

The scheme to aid the development of the Basket Willow industry was commenced in 1923. The work undertaken has included (*a*) the testing of varieties of willows, (*b*) the raising of new varieties, (*c*) manurial requirements, (*d*) propagation methods, (*e*) investigation of methods of preparation of rods for use and (*f*) a study of insect and fungus pests.

The tests of 110 varieties of willows have enabled a classification to be made. The trial beds have afforded material for further experimental work and have served as a source of supply of sets for growers in England and the Colonies.

Several thousands of seedlings are being raised from which selections will be made.

The manurial experiments have shown the particular importance to the plant of nitrogen and phosphorus.

Progress has been made in the methods of peeling rods, by the introduction of a peeling machine and by simplification in the methods of preparing "Buff."

The activities of the common insect and fungus pests have been studied and various treatments tested for dealing with such attacks in a more efficient manner than has been commercially possible hitherto.

Advisory work in connection with crop management has been extensive and four articles dealing with the subject have been published.

LING (A. W.). **Uniformity of Method in Sugar Beet Analysis.** *Intern. Sugar Journ.*, Feb., 1927.

Particulars of field and laboratory technique in examining sugar beet are discussed and details of a uniform method for both research workers and factory chemists are set out.

SPINKS (G. T.) **Progress Report on Fruit Breeding.** *Bath & West Journ.* 1926–27.

In 1926, approximately 350 different individual seedling apples bloomed, and fruit was obtained from 200 of these. Descriptions of the fruit from each seedling have been made and the chief points of interest regarding the trees were also noted. At present the number of individuals fruiting in any one family is too small to afford much genetical information. Two seedling apples were considered worthy of propagation for a more extensive trial.

A few plum seedlings bore a crop, and one, which cropped very heavily, is being propagated.

A final selection was made from a plantation of 1,300 black currant seedlings and each selected bush is being propagated in order to obtain a stock of plants for a large-scale trial.

Trials of previously selected seedling raspberries, loganberries and blackberries are being continued and several more plants from two families of seedling raspberries have been selected for further trial. A number of hybrid rubus seedlings have been planted out but have not yet fruited.

A considerable number of selected strawberry seedlings have been discarded as lacking in constitution, but the remainder are receiving a further trial.

SMALL ANIMAL BREEDING RESEARCH INSTITUTE, CAMBRIDGE.

PEASE (M. S.). **Genetic Studies in *Brassica oleracea*. II. The Kohl Rabi.** *Journ. Gen.*, Vol. xvii, pp. 253–266.

The swollen stem (or so-called bulb) of the Kohl Rabi is determined by three multiple factors, of which two are major, and the third is a minor or modifying factor. This conclusion is arrived at from a study of the distribution of the types in F_2, F_3, and the Back-crosses. Intermediate, half-bulbed types have been selected and shown to breed true.

The purple colour in the "blue" Kohl Rabi is due to two complementary factors. One of the major factors which controls the "bulb" in the Kohl Rabi is linked to one of the complementary colour factors, the crossover value being 30 per cent.

JOHN INNES HORTICULTURAL INSTITUTION.

ANDERSSON (I.). **A note on some characters in Ferns subject to Mendelian inheritance.** *Hereditas*, ix, 1927, pp. 12.

An account of the inheritance of various leaf-characters in *Polystichum angulare* and *Scolopendrium vulgare*.

CHITTENDEN (R. J.). **Vegetative Segregation.** *Bibliographia Genetica*. III. 1927, pp. 88.

A general survey of the subject, discussing chimaeras, bud variation, non-Mendelian variegation, mosaic anthocyanin distribution, etc. The author gives an account of much hitherto unpublished work done at the John Innes Horticultural Institution by the late Mr. William Bateson and his collaborators.

CHITTENDEN (R. J.). **Cytoplasmic Inheritance in Flax.** *Journ. Hered.* 18, 8, 1927, pp. 8.

A discussion of cytoplasmic, as opposed to nuclear, inheritance, with special reference to the work on flax.

CHITTENDEN (R. J.), and PELLEW (C.). **A Suggested Interpretation of Certain Cases of Anisogeny.** *Nature*, Jan. 1st, 1927.

The phenomenon of anisogeny as originally described by Mr. William Bateson is explained in terms of cytoplasmic inheritance.

CRANE (M. B.). **Studies in relation to Sterility in Plums, Cherries, Apples, and Raspberries.** *Mem. Hort. Soc. New York*, 3, 1927, pp. 16.

This paper summarises the results of many years' work on incompatibility and sterility in fruit trees. Tables are given for cherries, plums and apples.

showing which kinds are capable of setting fruit with one another. A note is added on the cytological work that has been carried out in collaboration by Mr. C. D. Darlington.

The economic and genetic aspects of the problems involved are discussed, and the cytological data, which are complex, are related to the phenomenon of incompatibility.

DARLINGTON (C. D.). **The Behaviour of Polyploids.** *Nature*, Mar. 12th, 1927, pp. 2.

Experimental breeding and cytological study are shown to suggest exceptional properties in polyploids.

DARLINGTON (C. D.). **Reversion in Black Currants; a Study of the Chromosome Complement.** *Journ. Pom. & Hort. Sci.* VI, Sept., 1927, p. 1.

The chromosome complements of *Ribes* species are described and reversion is shown *not* to be due to chromosome aberration.

HUSKINS (C. L.). **On the Genetics and Cytology of Fatuoid or False Wild Oats.** *Journ. Gen.*, xviii, 3, 1927, pp. 50.

The rogue strains known as 'fatuoids' in oats are shown to be due to chromosome aberration.

JØRGENSEN (C. A.) and CRANE (M. B.). **Formation and Morphology of *Solanum* Chimaeras.** *Journ. Gen.*, xviii, 2, 1927, pp. 27.

An account is given of the method by which chimaeras were formed by cross-grafting various *Solanum* species. Their development and their genetical, structural and cytological peculiarities are described.

NEWTON (W. C. F.). **Chromosome Studies in *Tulipa* and some related genera.** *Linn. Soc. Journ.* (*Bot.*) xlvii, Jan., 1927, pp. 16.

A cytological study of *Tulipa*, *Calochortus*, &c., with a detailed account of meiosis in certain tulips.

NEWTON (W. C. F.) and DARLINGTON (C. D.). **Meiosis in a triploid Tulip.** *Nature*, 120, July 2nd, 1927.

The abnormal behaviour of the chromosomes of triploid Tulips in meiosis is shown to correspond with the abnormal behaviour in breeding of triploid *Drosophila*.

PELLEW (C.). **The genetic behaviour of *Primula kewensis*;** *Zeitschr. f. ind. Abs. u. Vererbungslehre*, xlv, 1927, p. 1.

A preliminary note on the genetics of the true-breeding tetraploid hybrid *Primula kewensis*.

SVERDRUP (A.). **Linkage and Independent Inheritance in *Pisum sativum*.** *Journ. Gen.*, xvii, 1927, pp. 31.

A Mendelian study of the culinary pea.

SCOTTISH SOCIETY FOR RESEARCH IN PLANT BREEDING.

GREGOR (J. W.), & SANSOME (F. W.). **Experiments on the Genetics of Wild Populations. Part I. Grasses.** *Journ. of Gen.*, Vol. xvii. No. 3. 1927.

Until quite recently the connection of genetics and ecology has not been made prominent. The authors of this paper have endeavoured to emphasise the importance of the interrelation between wild environment and genetic constitution of the inhabiting forms.

The observations made on this subject suggest several important conclusions which may be summarised as follows:—

That there exist definite hereditary habitat types within the grass species.

That the habitat type represents the genotypical response of the species population to a definite habitat.

That there are two processes of selection in operation, (*a*) phenotype selection and (*b*) genotype selection.

That without doubt extreme environmental conditions alter the appearance of plants; should the effect of such conditions, however, be merely modificatory and not selective, the inherited properties of the population will remain unchanged.

That the conditions of the environment (other than direct competition among related species and races) are by no means unimportant. Under this head come the effects of high winds, animal and human activity, &c., which factors are, as selective agents, of very considerable importance in leading to the establishment of a definite type or variety.

MIDLAND AGRICULTURAL AND DAIRY COLLEGE.

ROEBUCK (A.). **Economic Ecology in North Lincolnshire.** *Trans. Lincs. Naturalists Union.*

A brief account is given of land near the Humber which was flooded during 1921–22 and rendered infertile. It is noted that on the arable land plants, with the exception of *Alopecurus agrestis* and *poa annua*, had ceased to grow and insect and allied life had disappeared. A repopulation by sundry plants and insects and worms may be said to have commenced during 1925.

SOUTH EASTERN AGRICULTURAL COLLEGE.

BURGESS (A. H.). **Report on the Fifth Season's Work at the Experimental Oast, 1925.** *Journ. Inst. Brew.* 58, 1927.

Among the results obtained may be mentioned the following:—

The results of experiments on the inter-relationship of time of drying, depth of loading and air speed show that the deeper the load, the greater will be the benefit derived from high air speeds; in the case of shallow loads the advantage is not great.

These three variables appear to be connected according to the expression $T=\frac{kD}{ax}+M$.

The rate of drying was found to be unaffected by burning sulphur under the hops. The effect of sulphur on the colour was marked; but no further improvement in this respect was obtained with concentrations of SO_2 greater than 1 oz. per 1,000 cu. ft. of air. The unsulphured hops developed an odour resembling dried leaves. Sulphuring appears to have no effect on the amounts of α or β resin.

Open and closed fire methods of drying were compared: the rate of drying, amount of resins and the general market value of the samples produced were the same in both cases.

The results of drying at temperatures ranging from room temperature to 212°F. show that the value of the hops as judged by colour and aroma, decreases as the temperature of drying is raised. The preservative value, as indicated by the resins, appears to be unaffected by temperatures up to 194°F.

Biological tests showed very little difference in the preservative values.

An experiment on the preservation of hops by sterilization with heat showed that the antiseptic value of sterilized hops, when tested biologically, is greater than that of the same hops dried in the kiln: the antiseptic value calculated from the resins content, however, is identical for the two samples. This appears to indicate the possible presence of some unknown antiseptic substance in the hop which is affected by drying.

WEST OF SCOTLAND AGRICULTURAL COLLEGE.

M'Candlish (A. C.). **Storing Swedes for Spring.** *Scottish Farmer*. Vol. xxxiv, No. 1766, p. 1455. 20th Nov., 1926.

There are various methods of storing swedes during winter—some are simply allowed to grow unprotected, others are earthed-up with the drill plow, some pulled and plowed-in, while some are pitted.

The influence of the methods of storage on the feeding value of a ton of roots and on the yield of nutrients obtainable per acre is of interest.

Experimental work on this problem has now been going on for two years. The influence of the various methods of storage on the yield of roots was determined by field trials and then the feeding value of the roots was tested each winter with a group of eight cows.

It was found that earthing-up or plowing-in the roots increased the yield per acre as compared with the yield obtained where the swedes were pitted or allowed to grow unprotected. It must be remembered, however, that the best method of storage for any locality will depend to a considerable extent on soil and climatic conditions.

So far only swedes that were earthed-up or plowed-in have been compared in feeding value with those allowed to grow unprotected. It has been found that, ton for ton, they are all of about the same value.

MINISTRY OF AGRICULTURE FOR NORTHERN IRELAND.

Mercer (S.), Dowey (E.) & Diamond (K.). **Reaction of Ryegrass Seed to Atmospheric Moisture.** *Min. Agric.—Seed Analysts' Bull.*, No. 12.

Daily weighings of dishes of whole perennial ryegrass seeds, shelled caryopses, and separated husks showed changes of weight in direct correlation with variations in percentage atmospheric humidity. Maximum change during twenty-four hours for whole seed was 3¼ per cent. Maximum aggregate change was 6·8 per cent. (=approx. 2 lb. per 28 lb. bushel). Husk absorbed and exhaled more easily than caryopses and showed greater maximum percentage absorptivity. Sackful units in warehouse behaved similarly, but changes were less violent. Italian was more energetic than perennial. Previous kiln drying augmented capacity in either direction.

(4) GRASSLAND.

WELSH PLANT BREEDING STATION, ABERYSTWYTH.

DAVIES (W.). **Seeds Mixture Problems: Soil Germination, Seedling and Plant Establishment with Particular Reference to the Effects of Environmental and Agronomic Factors. II. Field Trials.** *Welsh Plant Breeding Sta. Bull.*, Series H, No. 6, p. 39. Seasons 1923–1926. May, 1927.

Critical experiments dealing with soil establishment in herbage plants sown in the field are reported upon in connection with a number of Welsh soil types. A comparison is made between establishment in the seeding year and that of the first harvest year. A high positive correlation is found between the percentage establishment of viable seed and the grain weight of seed in herbage plants; this applies to a comparison of different species of grasses and clovers and also to strains within the species.

It is indicated that basic slag if applied at sowing time hastens the rate of soil germination of many grass "seeds".

The time and method of sowing "seeds" are discussed as is also the effect of cereal and other nurse crops.

DAVIES (W.). **Observations on Subterranean Clover.** *Journ. Min. Agric.*, Vol. xxxiv, No. 5, p. 455, Aug., 1927.

Much world literature dealing with this clover (an annual) is reviewed. Its high value as an element in grassland improvement is evidenced from the Australian and other results. Reference is made to seeding, seed production, manurial treatment, strain differences and resistance to disease.

The Welsh trials are discussed and it is shown that if seeded at the correct time (mid-June to mid-July in Wales) this clover will maintain itself in a pasture by annual reseeding and natural burial of its seed. Its potential value in British grasslands includes the provision of leguminous pasturage during the winter months.

DAVIES (WM.) & THOMAS (A. D.). **Seeds Mixture Studies: Some Carmarthenshire Results.** *Welsh Journ. Agric.*, Vol. iii, p. 147. Jan., 1927.

A number of experimental seeds mixtures were sown in 1923 24 at two centres in Carmarthenshire mainly to test the influence of sowing rye grass in temporary "seeds." Observational notes were kept throughout the course of the experiment and critical analysis was made in June, 1926. These data have shown that where the fields are not grazed during the first year the rye-grasses may exert an adverse influence upon the stand and productivity of other components of the mixture. Greatest harm appears to be done to those species characterised by slow initial development from seed, species which are, however, of high productivity when the plants are once well established.

The paper is of a preliminary nature and indicates that competition as exerted by the rye-grasses with the consequent sward spoliation is largely under the control of the knowledgeable grazier.

STAPLEDON (R. G.). **Characters which Determine the Economic Value of Grasses. I. Nutritive Value and Palatability.** *Journ. Min. Agric.*, Vol. xxxiii, No. 12. Mar., 1927.

Data are presented showing the chemical composition of the different parts of a grass. The higher nutritive value of the blade or lamina of grasses than of sheath or stem is clearly shown as is the high nutritive value of inflorescences. Leafage is also shown to be high in nutrients in proportion as it

grows quickly and is immature. Root leaves which have prolonged periods of growth are therefore richer in nutrients than stem leaves ; since root leaves are being continually produced the mixed ground leafage is always more nutritious than the elevated stem leafage.

Herbage is palatable in proportion as it is young and immature and in proportion as it is leafy and not stemmy, and in proportion as it is green, succulent and not burned. Stem leaves burn more rapidly than root leaves and adult herbage which has ceased to grow more rapidly than immature herbage still making active growth.

The different species differ widely in their reaction to winter burn.

Stapledon (R. G.). **Characters which determine the Economic Value of Grasses. II. Ratio of Leaf to Stem.** *Journ. Min. Agric.*, Vol. xxxiv, No. 1. Apr., 1927.

Sheep show a marked preference for the leaf of grasses over stem. The winter green grasses produce abundance of leaf shoots, while grasses tend to withstand heavy grazing in proportion as leaf shoots are produced in quantity. Even under close grazing all grasses tend to develop panicle shoots during May-June: pasture grass at this period always consists of its highest ratio stem to leaf. The closer the grazing the higher the ratio leaf to stem and this is so all the year round.

Stapledon (R. G.). **Characters which Determine the Economic Value of Grasses. III. Tiller Production and Powers of Resistance to Repeated Defoliation.** *Journ. Min. Agric.*, Vol. xxxiv, No. 2. May, 1927.

The different species vary greatly in their powers of tiller production and in the rapidity with which seedling plants develop new tillers. It is some of the smaller "bottom" grasses which produce the greatest number of tillers. Repeated cutting exercises a retarding influence on both tiller and root development, but reacts very differently on the different species. Cutting with a garden mowing machine exercises a greater influence than heavy grazing with sheep—but hard grazing brings about a reduction in both number of tillers and in root weight compared with taking hay and aftermath.

The evidence discussed in detail points to the extreme importance of conducting grazing on an intermittent and rotational basis.

Stapledon (R. G.). **Characters which determine the Economic Value of Grasses. IV. Persistency and Aggressiveness.** *Journ. Min. Agric.*, Vol. xxxiv, No. 3. June, 1927.

Too little is known concerning the extent to which our ordinary pasture grasses maintain themselves on old swards by re-establishment from seeding. Persistency is influenced by a large number of factors to which the several species react very differently. The most important of the factors are:—soil fertility; soil moisture; intensity of light; climate; growth form of the plant and palatability. On any particular habitat the species that persist are those able to withstand to a marked degree more exacting conditions of that habitat. Persistency is largely under the control of the farmer since soil fertility and intensity of grazing are two of the most important of the factors at work.

Stapledon (R. G.), Davies (W.) & Beddows (A. R.). **Seeds Mixture Problems: Soil Germination, Seedling and Plant Establishment with Particular Reference to the Effects of Environmental and**

Agronomic Factors. I. Garden Trials. *Welsh Plant Breeding Sta. Bull.*, Series H., No. 6. Seasons 1923–1926. May, 1927.

The date of sowing herbage seeds has a pronounced influence not only on establishment, but also on yield in the first harvest year, and this latter quite independently of establishment. The clovers have a shorter effective sowing season than the grasses. while the rye-grasses are less influenced by date of sowing than other grass species. March-July represents the full range of suitable sowing dates in the Aberystwyth district, having regard to the requirements of all species, while April and May have proved to be the most satisfactory months for sowing; this ensures good establishment before the wet conditions of the autumn set in, and encourages high yields in the first harvest year.

Stapledon (R. G.) & Davies (W.). **Seeds Mixture Problems: III. Establishment in Relation to the Drawing up of Seeds Mixtures: Being General Summary of the Evidence from the Garden and Field Trials.** *Welsh Plant Breeding Sta. Bull.*, Series H, No. 6, p. 64. Seasons 1923–1926. May, 1927.

Laboratory germination tests give but a slight indication of potential soil establishment. This is particularly true of the species with the smaller seeds and of samples having a poor viability. In many species the percentage establishment of the viable seed sown is less than half of the percentage germination. On the basis of the average number of established plants that can be expected from 1 lb. of commercial seed it is evident that current seed rates in grass mixtures are much too low in respect of species like meadow fescue, timothy, the meadow grasses and crested dogstail, for example. The evidence brought forward supports the theory of employing simple mixtures and of sowing large amounts of the comparatively few species employed to suit any particular set of conditions—and this is particularly necessary on poor soils and at high elevations.

Stapledon (R. G.), Fagan (T. W.), Evans (R. E.) & Milton (W. E. J.) **Italian Rye-Grass for Winter and Early Spring Keep: The Effec of Methods of Grazing on Productivity and Palatability, and on Chemical and Botanical Composition of the Herbage.** *Welsh Plant Breeding Station Bull.*, Series H, No. 5, p. 5. Mar., 1927.

Italian rye-grass sown under corn on April 2nd, 1925, was grazed on controlled plots on different systems to ascertain the effect on the yield and quality of the produce on March 30th, 1926. Plots grazed in September and then left till the crucial date produced more rye-grass leaf on that date than did plots left totally ungrazed from corn harvest ; and also gave a decidedly higher yield of protein per acre with much less burned leafage. On the crucial date, plots grazed in October and December gave a much higher yield than plots grazed monthly. The plots grazed monthly, however, gave the highest yield of dry matter and of nutrients for the whole period September–March. Evidence from sampling before and after the sheep showed that at all times green rye-grass leaf was preferred to burned rye-grass leaf or to sheath, stem proper, daisies or bent grass. The sheep having access to a number of plots of Italian rye-grass (each differently grazed previously) take an amount of keep from the several plots in inverse proportion to the total amount available—they show a preference that is to say for immature herbage. The blade of the leaf of Italian rye-grass is nearly twice as rich in protein as the sheath or as the stem; silica-free ash and lime are also appreciably higher in the leaf than in the stem.

WILLIAMS (R. D.). **Red Clover Investigations.** *Welsh Plant Breeding Sta. Bull.* Ser. H, No. 7. Seasons 1919–1926.

This bulletin is divided into three parts. Part I deals with botanical characteristics, studied statistically, Part II with the agronomic characteristics of most of the red clover varieties commonly grown in this country, while Part III contains a summary of the results reported in Parts I and II. It is shown that despite the wide variation that exists within each variety, it is possible to distinguish many of the varieties on the basis of their morphological and physiological characters. It was also found that the late varieties were not only far more lasting than the earlies, but that they were also much more productive even in the first year.

WILLIAMS (R. D.). **Montgomery and Cornish Marl Red Clover.** *Journ. Min. Agric.*, Vol. xxxiv, No. 2, p. 133, 1927.

This article deals with the botanical and agronomic characteristics of Montgomery and Cornish marl red clovers. Although these two clovers do not reach full development until about 4 to 5 weeks later than English broad red, they have at Aberystwyth almost consistently outyielded the most productive of the early varieties by a considerable margin even in the first harvest year.

However their outstanding characteristic is their ability to hold the ground well for three or more years and for this reason they are pre-eminently suitable for inclusion in mixtures intended to be down for two years or longer.

WILLIAMS (R. D.). **Clover Problems.** *Welsh Journ. Agric.*, Vol. iii, p. 106. Jan., 1927.

The first part of this article deals with the results of an experiment conducted with the object of investigating the problem of inter-varietal competition between two extreme forms of red clover. The results showed that there is a severe competition between early and late red clovers when they are sown together, resulting in reduced yields in the late varieties and increased yields in the early clovers.

In the second part of the article the results of experiments designed to determine the optimum time of cutting late-flowering red clover for hay are discussed. The data demonstrated that the reduced yield of hay obtained as a result of early cutting was compensated by a corresponding increase in the aftermath and that provided the hay is cut not earlier than the late bud stage and not later than the full bloom stage the time of cutting the hay has practically no effect on the aggregate hay and aftermath obtained. However, in view of the high nutritive value of the early cut hay and the fact that the late varieties are apt to become laid when in flower it is considered that the best stage at which to mow these clovers is during the late bud or early flowering stages.

UNIVERSITY COLLEGE OF WALES, ABERYSTWYTH.

FAGAN (T. W.). **The Nutritive Value of Grasses, as Pasture, Hay and Aftermath, as shown by their Chemical Composition.** *Journ. Univ. Coll. Wales*, Vol. xvi. 1927.

Individual grasses show considerable variation in the percentage composition of their pasture cuts, this being almost as great as the seasonal variation.

Their yield and chemical composition is to a large extent influenced by their ability to resist the cutting treatment (grazing) and by the leafiness of the growth.

The oftener the grasses are cut (or the harder they are grazed) the more leafy they become and consequently the better the produce from the point of view of chemical composition.

Where the grazing is hard, the yield of dry matter to the animal is not so great as where the grazing is lenient, but the composition of that dry matter is superior and does not vary to the same extent as when the interval is longer.

By a system of hard grazing, grasses such as Yorkshire fog and bent, which form a large proportion of the herbage of certain types of pastures, may contribute very materially to the nutritive value of such pastures.

The time at which hay is cut is a factor of the highest importance, and it is better to err on the side of early rather than late cutting; an interval of a week in the case of some grasses having a very pronounced effect on their chemical composition.

Aftermaths are characterised by their leafiness, which has a considerable effect on their nutritive value. The longer the grazing of the aftermath is delayed, the heavier its yield but the poorer its quality, and this is especially the case with the leaf portion.

UNIVERSITY COLLEGE OF NORTH WALES, BANGOR.

ROBERTS (R. ALUN). **Further Studies in the Formation of Permanent Pastures in North Wales.** *Welsh Journ. Agric.*, Vol. iii, pp. 84-89. 1927.

In a series of experiments on grassland establishment in North Wales, the particular series sown down in 1919-21 at thirteen centres are alone dealt with here. They were all examined botanically in the second and in the fourth years after sowing. The findings are briefly summarised thus: -

Out of a fairly comprehensive number of species originally sown the herbage in four years' time is drawn from Perennial Rye-grass, Wild White Clover, Crested Dogstail and Rough Stalked Meadow Grass, together with miscellaneous unsown plants.

Italian Rye-grass is an important grass for this area, where young leys are mostly put up for hay and where there is a heavy stock of sheep to be carried over winter.

Meadow Fescue and Timothy only very occasionally survive unless the land be continuously mown. The fact of indigenous forms of both these grasses occurring together with indigenous Fine-leaved Fescues in pastures of high reputation in the area suggests that such forms if isolated would be far superior to commercial stocks.

Red Clover and Alsike do not survive the conditions prevailing and Yarrow and Chicory are but poorly represented after a few years.

The initial mixture must be drawn from the few persistent species, together with provision for hay in the early life of the ley from fugitive elements such as Italian Rye-grass and Red Clover. The ley should also be ploughed up sooner (at about the fourth year) immediately it has ceased to be profitable and not, as is often the case now, when it is obviously degenerate.

SEALE-HAYNE AGRICULTURAL COLLEGE, NEWTON ABBOT.

WYLLIE FENTON (E.). **Hubam Sweet Clover.** *Journ. Min. Agric.* Vol. xxxiii, No. 9. Dec., 1926.

Hubam Sweet Clover or Hughe's Sweet Clover is an annual variety of Bokhara, Kabul or Sweet Clover (*Melilotus alba*, Desr), and is not a clover but a melilot.

In the trials in the botanical plots at Seale-Hayne Agricultural College, it showed a strong tendency to go back to the biennial habit as the number of biennial plants obtained from seed each year showed a steady increase.

It is very liable to suffer from cold, drought, excessive wetness, and is easily killed by frost. The early stages of growth seem very critical, but after that stage there is not much difficulty. It requires a good tilth and soil well cleaned of weeds, while drilling gives much better results than broadcasting.

The turnip flea beetle did great damage and raises the question if it can be grown in districts where the pest is bad.

In yield it proved not so good as many other leguminous plants grown in this country. It cannot be recommended under the ordinary conditions of British farming.

Wyllie Fenton (E.). **The Composition of Devon Pastures.** *Agric. Prog.* 1927.

The composition was obtained by the grid method of Armstrong. Examples are given of pastures which are semi natural and others which are reverting to that condition as well as others in different situations. Detailed analyses of twenty-four examples are given and discussed.

One of the most noticeable features of many pastures is the effect of inadequate stocking.

Wyllie Fenton (E.). **The Influence of Grazing on Vegetation.** *Trans. Torquay Nat. Hist. Soc.* 1925–26.

This is a study in ecology with an agricultural bias. An area of ground on the famous Bovey Clay Beds is selected and a small plan given. Originally the same, the fields are now very different, due almost entirely to the grazing factor.

Previous to 1914–15, the area was chiefly a golf course and grazed with sheep. Since then one part has been allowed to revert and only rabbits have had any influence in keeping grassland from becoming scrub and heath. In the adjoining field the pasture is of a poor type and rough, being grazed too lightly by stock and occasionally horses. The grazing is however sufficient to hold the heath formation in check. In the third field where grazing is adequate the pasture is quite typical of many pastures in Devon. Here cattle, sheep and horses have grazed.

EDINBURGH AND EAST OF SCOTLAND COLLEGE OF AGRICULTURE.

Smith (W. G.). **The Influence of Sheep Grazing on Hay.** *Scottish Journ. Agric.*, Vol. x, No. 3, July, 1927, 6 pp.

Late grazing is a common practice on sheep farms during the lambing season, and observations have been made as to the effect of this on fields intended for hay. It was found that in rotation grass land, late grazing into May interferes with hay production, since most of the grasses sown in grass mixtures fail to reproduce ears. Exceptions are Rye Grass and Crested Dogstail, which ear freely even after severe late grazing. The same was observed in old grassland such as is used for hay on sheep farms. If sheep are excluded from these in March the hay crop will be much heavier than if grazing is carried on until late April or May.

(5) ENTOMOLOGY

and Plant Helminthology.

HORTICULTURAL RESEARCH STATION, CAMBRIDGE UNIVERSITY.

WOODMAN R. M. **The Solubility of some Likely Spray Substances in Solvents containing Soap. The Preparation of Spraying Solutions.** *Journ. Agric. Sci*, Vol. xvii, pp. 44–59. Jan., 1927.

Work on the physico-chemical properties of spray fluids has been continued, especially with regard to the properties of oils and oil emulsion.

It has been shown that the paraffin or lighting oils often advocated in this country are not suitable for spraying purposes, as they contain too great a percentage of low-boiling constituents. The higher-boiling petroleum lubricating oils are, therefore, recommended.

Petroleum fractions can be sprayed as actual solutions when incorporated with soaps and certain phenolic compounds, which are themselves insecticidal and fungicidal: coal tar fractions, however, such as anthracene oil, cannot be economically dissolved, and will have to be supplied as emulsions. The optimum methods of preparing oil solutions are discussed.

Methods are given for the preparation of "miscible" oils, and for the easy formation of "stock" or "free" emulsions.

The drawback to all the mineral oils at present used in spraying is that, however careful the preparation, they must vary, sample from sample, in composition, physical properties, and presumably, toxic action and effect on trees: this is because the oils are complex *mixtures* of hydrocarbons. The only method of obtaining at will an unvarying sample of mineral oil is to use an oil which is a definite, single, chemical compound. Two oils derived from naphthalene (a coal tar product), namely, dekalin and tetralin, have been experimented on, as they show decided insecticidal properties. Solutions of these are uneconomic, but "miscible" oils, some of which give emulsions more easily than any proprietary oil wash the experimenter has dealt with, have been successfully prepared. The price of these miscible oils compares very favourably with that of other miscible oils on the market, and besides being standard, they have the added advantage of being non-injurious to health.

WOODMAN R. M. **On the Causes of Solubility.** *Journ. Physical Chem.* 1927, xxxi, 1742.

The investigation was undertaken to arrive at some distinction between solubility and emulsification and to throw some light on the factors involved in the choice of emulsifiers to give the correct type of spraying emulsification.

EXPERIMENTAL AND RESEARCH STATION, CHESHUNT.

SEVER E. R. **An Important Parasite of the Greenhouse White-fly** *Trialeurodes vaporariorum* **Westwood.** *Bull. Ent. Res.*, Vol. xvii, pt. 3, pp. 301–308, with 3 plates. London, Mar., 1927.

The chalcid, *Encarsia Formosa* Gahan, was found parasitising pupae of the Greenhouse White-fly in Britain in 1926. An account of the life-history and habits of the parasite are given.

Experiments in distribution of the parasite in tomato houses are described and it is established that fumigation with hydrocyanic acid as practised on tomato nurseries does not kill the parasite.

HORTICULTURAL RESEARCH STATION, EAST MALLING.

AMOS J., HATTON R. G., KNIGHT R. C. & MASSEE (A. M.). **Experiments in the Transmission of "Reversion" in Black Currants.** *Ann. Rep. East Malling Res. Station*, ii, Supplement. Mar., 1927.

Ninety per cent. of normal black currant bushes developed reversion sooner or later after successful artificial infection with big-bud mites.

Ninety-two per cent. of normal bushes (controls) in which big-bud did not appear, developed no reversion symptoms.

Reversion appeared in three bushes on the absence of big-buds.

Big-buds appeared in five bushes unaccompanied by reversion.

There is very little relation between the number of visible big-buds and the intensity of accompanying reversion symptoms.

Reversion has appeared in 100 per cent. of previously normal individuals grafted to or inarched with reverted plants.

In these cases the symptoms appear after a lapse of one season following the grafting or inarching operation.

The evidence is strong, but not conclusive, that transmission of reversion in these cases was independent of big-bud mites.

It has not been possible to induce reversion by metabolic disturbance, nor to transmit the disease by sap transfusion.

It has not yet been possible to demonstrate the transmission of reversion through the seed.

The evidence obtained indicates that the disease is not regularly nor easily transmitted by the pruning knife.

GOODWIN (W). MASSEE (A. M.) & LE PELLEY (R. H.). **Tar-Distillate Washes. Their Comparative Effectiveness, under different conditions, on various Pests, and at increasing Concentrations.** *Journ. Pom. & Hort. Sci*, Vol. v, No. 4. Oct., 1926.

In preliminary trials in the field, against Hop-Damson Aphis, tar-distillate washes of known composition did not prove superior to a proprietary article. None of the washes, however, proved sufficiently toxic under the conditions described.

In similar trials, under laboratory conditions, the washes appeared much more toxic. It was noticeable that a much higher normal hatch was also obtained on shoots indoors.

Some information was obtained as to the effectiveness of a tar-distillate wash against Winter Moth eggs in the field. At 7½ per cent. the results were encouraging.

Preliminary indications suggest that although higher concentrations of tar-distillate may slightly increase the actual efficiency, probably the optimum strength lies between 5 and 10 per cent.

The experiments indicate the possibilities of evolving a fairly accurate technique for measuring the efficiency of egg killing washes in the field.

LE PELLEY (R. H.). **Studies on the resistance of Apple to the Woolly Aphis.** *Journ. Pom. & Hort. Sci.*, Vol. vi, p. 209.

References are made to papers dealing either wholly or in part with the resistance of varieties of apple to the Woolly Aphis (*Eriosoma lanigerum* Hausm).

The technique used for artificial infection of apple with this insect is described. A short account is also given of troubles caused by certain apple pests, and the methods used against them.

The question of resistance is discussed, and methods used in the attempt to determine the degrees of resistance of varieties of apple root stocks are described and examined.

A description of the results of heavy artificial infections of Northern Spy is given, and mention is made of its use as "control" particularly when examining highly resistant plants.

Tests of commercial root stocks showed one out of 18 varieties of stock tested, to be more resistant than all the others, but no further definite grouping according to degrees of resistance was found possible.

The preliminary results from artificial inoculations of 18 commercial scion varieties show that many of them is immune or highly resistant. Four other varieties reputed to be resistant were tested.

First inoculations on mature trees proved by the process of rooting whether there is constitutional difference in stock and scion with respect to Woolly Aphis resistance, show no definite results in favour of belief in such [illegible] but render probable the possibility that there is difference in this respect it is slight.

Tests of seedlings [illegible] from crossing Northern Spy with susceptible varieties have shown that the factor or factors which determine [illegible] are inherited. [illegible] Northern Spy is heterozygous in respect of this character.

MASSEE (A. M.). **Notes on Insects and Other Pests, 1925.**—*Ann. Rept. East Malling Res. Station*, ii, Supplement. Mar., 1927.

The following insects are briefly referred to:—The Hop Frog Hopper (*Philaenus spumarius*) has been common in some hop gardens during May, June, July.

The Apple Sawfly (*Hoplocampa testudinea* Klug) appears to be on the increase, the varieties most heavily attacked being James Grieve and Worcester Pearmain.

The clear coloured weevil (*Otiorrhynchus picipes*, F.) has been doing severe damage to young black currant bushes and newly grafted apple stocks.

The fruit tree Red Spider (*Bryobia ribis*, C. L. Koch) proved to be one of the most prevalent pests in the Maidstone district during 1925. It was recorded on Apples, Pears and Plums, Apples being most severely attacked.

Control measures carried out in the field are briefly discussed.

MASSEE (A. M.). **The Gall Mites of the Himalaya Berry and Raspberry.**—*Ann. Rept. East Malling Res. Station*, ii, Supplement. Mar., 1927.

The Gall Mite (*Eriophyes gracilis*, Nal.) was commonly found on both Himalaya Berry and Raspberry.

The life cycle of the Mite is briefly referred to. The mites feed on the under surface of the leaves during the summer. Galls are not produced on the leaves, but the foliage becomes somewhat mottled after a heavy infestation. The mites shelter under the bud scales during the autumn and winter.

The mites have always been found in greatest numbers on canes showing abnormal foliage.

MASSEE (A. M.). **Observations on the Presence of Mites** (*Eriophyes ribis*, Nal.) **upon Black Currant Bushes Manifesting Reversion and Big-Bud.** *Ann. Rept. East Malling Res. Station*, ii, Supplement. Mar., 1927.

Some badly reverted Black Currant bushes showing little or no big bud were examined for the presence of Mites. Very few mites were found on the bushes, and it is suggested that the bushes were actually potential cases of reversion when planted as cuttings, and that the subsequent manifestation of Mite attack was merely secondary.

Mites were frequently found in buds apparently quite normal.

Black Currants of the Goliath group were noted to have a number of swollen buds which would generally be diagnosed as big buds caused by mite attack. However mites were not present in these so-called spurious big buds which appear to be a varietal characteristic of the group.

Massee (A. M.). **Field Experiments with Dormant Winter Washes** *Ann. Rep. East Malling Res. Station*, II. Supplement. Mar., 1927.

Spray fluids containing dinitro-o-cresol or the sodium salt showed a high efficiency against eggs of the Hop Damson Aphis (*Phorodon humuli* Schr.) on plum trees on a larger scale under field conditions. The trees sprayed with these compounds remained almost free from aphides during the following spring when the control trees were badly infested.

A quantitative method for judging the results of the field experiments was worked out. This involved recording details of large numbers of eggs on selected shoots on sprayed and control trees before and after spraying, a numerical measure of the effect of the various treatments being thus obtained. The method gave consistent and reliable results.

The spray fluids containing dinitro-o-cresol and its sodium salt had a marked general cleansing effect on the trees. No injury to the trees was observed.

Massee (A. M.). **The Control of the Apple Blossom Weevil.** (*Anthonomus pomorum* L. Curt.) **A Summary of Results.** *Ann. Rept East Malling Res. Station*, A8, p. 66.

A number of measures frequently recommended for the control of the weevil are discussed briefly. Of these measures it has been found by experiment that the weevil cannot be controlled by enclosing hens in an infested plantation. Poultry will not take readily the weevil as food. The jarring and grease-banding of the trees gave negative results. Lime washing and arsenical sprays proved useless for this pest.

However, the weevils may be controlled successfully by trapping them in sack bands. The bands are placed around the trunk of the tree during May. The weevils go into bands to hibernate, and remain there until following spring. Bands must be removed by the end of January, and the weevils in them destroyed. Full details of the manipulation of the bands is given in the text. In severe instances of attack it is necessary to repeat the banding operations the following season.

LONG ASHTON FRUIT RESEARCH STATION.

Lees (A. H.). **Insect Attack and the Internal Condition of the Plant.** *Ann. App. Bio.*, Vol. xiii, No. 4, p. 506. Nov., 1926.

Attention is drawn to the fact that when the recognised factors governing insect multiplication are considered there still appears to be a factor (or factors) outside these that has a direct bearing on the success of the insect. Thus weather conditions, insect enemies, fungi, hereditary resistance are well known controlling factors, but the effect of the internal condition of the plant has perhaps not received so much attention as it deserves.

In many cases the internal condition is the direct result of external conditions, and in this connection the work of Kraus and Kraybill is referred to. Fourteen cases, drawn from all parts of the world, are cited where apparently there has been such a connection. The specific connection is not the same in all cases. Rainfall and interference of sap flow frequently exert a great influence and two cases at any rate seem to point to the importance of the carbohydrate-nitrogen ratio. The writer, however, takes the view that while the evidence is sufficient for thorough investigation of the possible connection between the condition of the plant and insect attack the case is far from being proved.

Smith (L. E.). **Investigations on Tar Distillate Fluids.** *Ann. Rept Agric. & Hort. Res. Sta., Long Ashton*, 1926.

The paper contains a summarised account of chemical investigation designed to examine the effects of the various factors concerned in the pre-

paration of (*a*) clear concentrated tar oil fluids ; (*b*) stable dilute tar oil emulsions.

Several brands of commercial tar oils were used in the preliminary tests but the main work was carried out on three types of oil: a Vertical Retort Tar Oil, B.P. 180° C.—360° C, Tar Acid content 25 per cent. ; a Horizontal Tar Oil, B.P. 190° C.—360° C., Tar Acid content 12 per cent. ; Coke Oven Tar Oils, varying B.P. ranges and tar acid contents.

The following points were investigated: the preparation of concentrated tar distillate fluids ; physical properties of concentrated tar oil fluids ; addition of water to cause turbidity in fluids ; changes in properties on the gradual dilution of fluids with water; stability of tar oil emulsions; functions of tar acids in emulsions; stability of tar oil emulsions in the presence of electrolytes.

ROTHAMSTED EXPERIMENTAL STATION.

DAVIDSON (J.). **The Biological and Ecological Aspect of Migration in Aphides.** *Science Prog.*, pp. 641–658. 1927.

These insects may be separated into two groups according to whether the life-cycle is completed on one type of plant (non-migrating species); or, whether part of the cycle occurs on one type of plant, on which the fertilized eggs are laid (primary host), and the other part, which consists only of parthenogenetic generations, on other types of plants (intermediate hosts), between which there is a regular, periodic migration. With the migrating species, the primary host-plants are trees or shrubs (excluding species like the pea aphis (*Mac. pisi*), which migrate only between herbaceous plants); the intermediate food-plants may be herbaceous plants, or other trees and shrubs. The normal life-cycle is practically confined to species in temperate climates. In certain warm countries the sexual phase is frequently suppressed and continuous parthenogenetic reproduction occurs. The migrating habit has developed in association with the changes in the world's flora. Those species which are primarily non-migrating, such as members of the tribe Lachnini and Callipterini, exhibit certain primitive characters, which place them among the least specialised forms. The migrating species, on the other hand, exhibit a varying degree of specialisation of habit and form, correlated with the extent to which the migrating habit has developed.

DAVIDSON (J.). **On the Occurrence of Intermediates in *Aphis Rumicis* L. and Their Relation to the Alate and Apterous viviparous Females.** *Journ. Linn. Soc. London.* 1927.

The occurrence of winged or apterous parthenogenetic females in various generations in the life cycle of aphids is an important consideration with reference to the migrating habits of those insects.

The experimental evidence indicates, however, that with certain of the summer generations, the proportion of alate or apterous viviparous females which may develop in any particular generation is affected by environmental factors, particularly nutrition and temperature.

This evidence is supported by the occurrence of parthenogenetic forms which morphologically are intermediate between the apterous and alate forms. A number of such intermediates of *Aphis rumicis* have been reared and their genetical history followed. These intermediate forms range from an almost apterous condition to an almost winged state in appearance. They behaved physiologically like apterous forms, especially in the kind of offspring they tended to produce. They are considered as individuals tending to the normal alate type, but owing to certain physiological conditions at present not determined, the development of wings and associated structures has been

partially suppressed. In the normal apterous viviparous females these features have been completely suppressed. The conclusion is, therefore, that the potentiality for wing development is latent in the apterous viviparous females. The apterous condition is secondarily derived from the primitive alate condition. The apterous forms are more prolific than the alate forms and their development on the plants ensures the establishment of large colonies.

DAVIDSON (J.). **On some Aphides infesting Tulips.** *Bull. Ent. Res.* xviii, Sept., 1927, pp. 51–62: 1 plate and 7 text-figs.

A detailed technical description is given of three species of aphids obtained from various sources on tulip bulbs and iris corms. These species were reared and observations made on the progress of infestation on tulips. *Anuraphis tulipae* is shown to be a serious pest of stored bulbs and when the latter are grown early in the season in glasshouses, multiplication becomes rapid on the growing leaf-spathes which leads to distortion of the plants. The other species viz., *Rhopalosiphoninus tulipaella* and *Macrosiphum gei* are of less importance: the first mentioned along with *Anuraphis tulipae* have up to the present, been imperfectly known and detailed figures illustrating their distinctive characters are given. Infested stored bulbs should be collected and subjected to treatment in order to prevent widespread infection of other bulbs in the same store and various methods of treatment are given.

DAVIES (W. M.). **Collembola Injuring Leaves of Mangold Seedlings.** *Bull. Ent. Res.*, xvii, pt. 2, pp. 159–162, 2 pls., 5 refs. London, Oct., 1926.

Although the economic position of Collembola has not yet been fully established, *Smynthurus* (*Bourletiella*) *hortensis*, Fitch, is the most important. It attacks a very great variety of plants; lists of its food-plants in Britain and Canada are given.

Damage to mangels has been previously reported and this paper deals with a method of control that was successfully employed. Leaf damage was reported on 31st May, 1926, before the roots had appeared above ground, and practically 100 per cent. of the plants were found to be infested with S. hortensis. The ability of such small insects to cause comparatively extensive injury is due to their habit of feeding in groups. The attraction of exuding plant juices doubtless led to the formation of this habit, so that the leaves are not only bitten, but the wounds are kept open and excessive bleeding ensues.

Field conditions in the early morning were found to be more constant for comparative work, and observations were made at 6.30 a.m. on 1st June. As the insects jump at the slightest disturbance, counts were made by placing a glass cylinder, 3½ inches in diameter by 6 inches in height, quickly and quietly over a group of plants, four being the number aimed at, and counting the insects knocked off on to the soil inside. Twenty random counts gave an average of 19·7 per unit area (approx. 9 sq. inches) or about 1,500,000 per acre.

The first treatment was made with paraffin-soaked sacks trailed behind a flat horse-roller; few insects were observed on the treated plants, while those on the ground were very active, but heavy rain fell in the night, and it was evident that the repellant effect of the paraffin had disappeared. Efforts were then made to catch the insects on tarred sacks trailed over the ridges so that they were caught on the tar as they jumped. White varnish, which was almost as successful as the tar, was used to show more clearly the large number of insects caught.

The most successful improvised apparatus used consisted of two Planet hoes fastened together by two crossbars, long enough to cover two ridges

in width, over which was hung a sack turned up to 9 inches from the bottom. This turned surface just reached above the two ridges, and a similarly turned sack was hung perpendicularly behind. In order to avoid disturbing the Collembola by shadow, it was found essential to push this contrivance. This treatment reduced the infestation so much that it may be said to have saved the crop. Other contrivances for carrying the turned sacks are mentioned, one of the best consisting of a pair of old bicycle wheels turned by an iron axle to which were bolted two L-shaped brackets adjustable by numerous lengths of ridges, the horizontal arms projecting forwards and bolting on the underside an inch-shaped wooden box. A piece of strong string was hung loosely across the inside of the archway and thus trailed over the plants just in front of the sacking, which forms the back of the arch. The metal box and sacking were smeared with tar, and the whole contrivance was pushed by means of a fairly long handle. This machine has also been used successfully against flea-beetles, but since they jump higher than Collembola, a piece of 3-ply wood smeared with tar is fixed in a slanting position on the top of the box.

DAVIES (W. M.). **Methods of collecting Parasites of Earwigs.** *Bull. Ent. Res.*, xvii, June, 1927, pp. 347–350, 1 plate and 1 text-fig.

Describes the methods devised for collecting large numbers of earwigs and breeding out pupæ of their chief parasite *Digonochaeta setipennis*. The work was carried out in response to a request for parasites with a view to accompanying the biological control of earwigs in New Zealand where they are a serious pest.

DAVIES (W. M.). **On the Tracheal System of Collembola, with special reference to that of *Smynthurus viridis* Lubb.** *Quart. Journ. Micros. Sci.*, Vol. 71, part i, May, 1927, pp. 15–30.

The presence of only a single pair of spiracles of *Smynthurus viridis* constitutes a unique condition among adult insects. The position of these is in the anterior region of the prothorax and not in the head or cervicum as previously believed. The structure of the spiracles is extremely primitive and they possess no closing apparatus. The tracheæ branch dichotomously, but no anastomosis exists between the systems of the two sides of the body. Tracheæ are found to be a constant feature in all members of the Smynthuridæ examined. Various methods of technique adopted are given.

GUNNING (C. T.) & TATTERSFIELD (F.). **Laboratory and Field Experiments on the use of 3. 5-Dinitro-o-cresol and the Sodium Salt for Winter Spraying.** *Journ. Agric. Sci.*, Vol. xvii, Pt. ii, Apr., 1927.

The toxicity of 3 : 5-dinitro-o-cresol and its sodium salt to the eggs of several species of moths has been determined under laboratory conditions. Both substances are toxic to eggs of the species tested at concentrations varying from 0·1 to 0·025 per cent.

With eggs of some insects, hatching is not entirely prevented by the action of low concentrations of dinitro-cresol and sodium dinitro-cresylate, but the majority of the larvæ which emerge succumb within a few hours.

The eggs of "red spider" are very resistant to the action of dinitro-cresol.

At equivalent concentrations, dinitro-cresol and sodium dinitro-cresylate have approximately the same toxicity to insect eggs.

Washing eggs with water after spraying has no appreciable effect on the toxicity of dinitro-cresol, if the liquid is first allowed to dry on the eggs. Sodium dinitro-cresylate is more affected by washing after spraying.

Field experiments on apples and black currants with spray fluids containing dinitro-cresol at a concentration of 0·25 per cent., and sodium dinitro-cresylate at equivalent concentration showed that both materials were completely effective against Psylla and Aphis eggs and greatly reduced the numbers of caterpillars. There was no evidence of any effect on Capsid eggs.

Both fluids had a cleansing effect on the bark of the trees, killing algæ, lichens, &c.; they caused no injury to the trees themselves. The results demonstrate the practicability of using dinitro-cresol and sodium dinitro-cresylate as winter spray fluids on dormant trees and bushes under field conditions.

Imms (A. D.). **On the Affinities of the Grylloblattidae.** *Psyche*, Vol. 34, pp. 36–39. 1927.

A discussion of the affinities of this family based upon material obtained while in the United States. It is pointed out that from a re-examination of its morphology the evidence so derived indicates that the affinities of the family lie closer with the Cursoria group of the Orthoptera than with the Saltatoria section of that order.

Morland (D.). **On the Microscopical Examination of Bees for Acari.** *Ann. App. Bio.*, Vol. xiii, pp. 503–505 with two text-figs.

Describes a method of exposing the tracheal system of the bee for purposes of examination for acarine disease.

Morris (H. M.). **The Insect and other invertebrate Fauna of arable land at Rothamsted. Part II.** *Ann. App Bio.*, Vol. xiv, No. 4, Nov., 1927, pp. 442–464.

Samples of soil were taken from six of the plots of Barn Field on the farm of the Rothamsted Experimental Station, and the Insects and other Invertebrates found therein are recorded together with the approximate depth at which they occurred. On these plots one receives no manure, one superphosphate only and one ammonium salts only, while of the other three, all of which receive dung, one receives superphosphate and potash, and another ammonium salts in addition. From the figures obtained in this investigation it appears that artificial manures have little or no effect on the soil fauna, while the effect of dung in increasing fauna is very considerable.

Tattersfield (F.) & Gimingham (C. T.). **Studies on Contact Insecticides. Part V.—The Toxicity of the Amines and N-Heterocyclic Compounds to *Aphis Rumicis* L.** *Ann. App. Bio.*, Vol. xiv, No. 2. May, 1927.

The toxicities to *Aphis rumicis* of certain aliphatic and aromatic amines and of some of the simpler nitrogen-heterocyclic derivatives have been quantitatively determined.

Tetramethylammonium hydrate and chloride are more toxic than the corresponding tetraethylammonium compounds. This is in keeping with the findings of Dale and his co-workers who have shown that tetramethylammonium has certain physiological effects similar to those of nicotine which are not shown by tretraethylammonium.

The aromatic amines, on the whole, show little insecticidal action. Aniline and most of the aliphatic amines are only slightly toxic to *A. rumicis*. The substitution of aromatic g oups in the amino group of aniline increases toxicity more than the substitution of aliphatic groups. There are interesting

relationships in regard to toxicity among these compounds. For example, the following orders of toxicity were noted :

Phenylamine (aniline)<diphenylamine>triphenylamine.
Phenylamine (aniline)<benzylaniline>dibenzylaniline.
Benzylamine<dibenzylamine>tribenzylamine.

o-Nitraniline is one of the most toxic of the aniline derivatives.

α-Naphthylamine is more toxic than aniline. Substitution of various radicals in the amino group of aniline has a greater effect on the toxicity of the resulting compound than substitution of the same radicals in α-naphthylamine. α-Naphthylamine derivatives are more toxic than the corresponding β-derivatives.

Among the heterocyclic compounds, nicotine is highly poisonous to *A. rumicis*. The heterocyclic rings constituting the molecule of nicotine are much less toxic than nicotine itself ; pyrrole and pyridine show comparatively slight insecticidal action. The order of toxicity of the simpler N-heterocyclic compounds runs :

Pyrrole<pyridine<picoline<lutidine<quinoline and isoquinoline>acridine.

Hydrogenation of pyridine and pyrrole increases their toxicity ; piperidine is more toxic than pyridine and pyrrolidine than pyrrole.

Benzyl-pyridine is the most toxic pyridine derivative tested.

TATTERSFIELD (F.) & GIMINGHAM (C. T.). **Studies on Contact Insecticides. Pt. VI. The Insecticidal Action of the Fatty Acids, their Methyl Esters and Sodium and Ammonium Salts.** *Ann. Appl. Biol.*, Vol. xiv, No. 3, Aug., 1927.

The toxicities to *Aphis Rumicis* L. of the fatty acids from formic to stearic and of the sodium and ammonium salts and methyl esters, applied as spray fluids, have been quantitatively determined. Two unsaturated acids, undecenoic and oleic, are included.

TATTERSFIELD (F.). **The Relationship between the Chemical Constitution of Organic Compounds and their Toxicity to Insects.** *Journ. Agric. Sci.*, Vol. xvii, Pt. ii. Apr., 1927.

The various classes of insecticides are outlined, and the sense in which the term "contact insecticide" is used is defined as one which is brought into external contact with the insect, either as solid, liquid, or vapour.

An analysis is made of the relationships between chemical constitution and insecticidal action in the vapour phase. There is rough correlation between both the molecular weights and volatilities of organic compounds and toxicity, but it is probable that these relationships are only indirectly involved and that they indicate a connection of a more direct kind with some other property such as absorption.

An account is given of the toxicity to insects of certain plant products. The most potent of these are certain tropical leguminous plants used as fish-poisons. A brief account is given of the chemical derivatives found in these plants. One of them, "tubatoxin," is one of the most potent contact insecticides known.

A list of the groups of organic chemicals tested for their toxic action on *Aphis rumicis* and the eggs of *Selenia tetralunaria* is given. A more detailed account is given for each group of the relationships between chemical constitution and insecticidal action. It is shown that the substitution of certain radicals in the benzene ring profoundly affects toxicity, but that toxic action depends not only upon the radicals but the number substituted and in certain cases upon their relative position.

3 : 5-Dinitro-o-cresol is shown to have a most powerful ovicidal effect.

An examination of the toxicity of the fatty acids is made. It is shown that as the series is ascended toxicity increases up to undecylic acid, after which it declines.

An analysis is made of the bearing of certain of the physical properties of these acids upon toxicity; such as volatility, physical state, partition coefficients, dissociation constants and surface tensions of their solutions in water. None of these properties entirely accounts for the toxicities shown by the fatty acids, but to a certain extent with some of them correlation is sufficiently close to indicate the necessity of further study but on simplified lines.

INSTITUTE OF AGRICULTURAL PARASITOLOGY, LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE.

Goodey (T.). **A Further Note on *Hexatylus viviparus* Goodey, 1926.** *Jour. Helminth.*, Vol. iv, Nos. 4–5.

In a paper published earlier in 1926 the writer gave a description of a new genus of nematode, obtained from a rotting potato, somewhat similar to *Tylenchus* but differing in the shape of the esophagus, the number of swellings at the base of the stylet and in the position of the vulva.

In the present note the same worm is recorded from a diseased Gladiolus corm and further measurements relating to it are given. So far only female specimens have been found and it is suggested that the worms are probably not parasitic but saprophytic in their mode of life.

Goodey (T.). **On *Tylenchus graminis* (Hardy, 1850), Marcinowski, 1909.** *Journ. Helminth.*, Vol. v, No. 3.

Small purplish galls occurring on the leaf-blades of the pasture grass, *Festuca duriuscula*, were found to contain nematode larvae very similar in appearance to those obtained from galls on wheat caused by *Tylenchus tritici*. Fresh galls were produced on grasses grown in pots sown with seed of *Festuca duriuscula* and *F. ovina* and infected with dried galls. The morphology of the adult male and female worms obtained from new galls is described and figured and compared with that of adult *Tylenchus tritici*. The second stage larvae of the two species are also figured and compared. The view is advanced that the species is a true one and distinct from *T. tritici*.

Goodey (T.) & Triffitt (M. J.). **On the Presence of Flagellates in the Intestine of the Nematode *Diplogaster longicauda*.** *Protozoology*, No. 3.

Examples of *Diplogaster longicauda* occurring in some rotting Narcissus bulbs attacked by *Tylenchus dipsaci*, were found containing active flagellates within the lumen of the intestine. The organisms often occurred in large numbers and were investigated in the living condition and by means of smear preparations made by crushing infected worms between two coverslips with subsequent fixation and suitable staining. They were found to be of the leptomonad type, varying in length from 8-14 μ by 1-2·4 μ in width. Each possessed a single anterior flagellum about 10 μ long inserted into the body with a kinetoplast at its base. Crithidial forms and small stumpy organisms with long flagella were also found. The naming of the flagellates is left open for the present.

UNIVERSITY COLLEGE OF WALES, ABERYSTWYTH.

Jenkins (J. R. W.). **A Survey of the Insect Pests of Mid and West Wales.** *Welsh Journ. Agric.*, Vol. iii, 1927.

This is the result of a survey of four years' duration over an area of 4,859 square miles and is a fairly complete record of the insect pests of the area.

UNIVERSITY COLLEGE OF NORTH WALES, BANGOR.

WALTON (C. L.). **Further notes on Warble Flies in North Wales.** *Welsh Journ. Agric.*, Vol. iii, pp. 164–169. 1927.

This paper continues and extends a previous contribution (*op. cit.* vol. i, 1925). The present paper records the observation of 1,738 cattle of all ages, which yielded 7,008 warbles, giving a gross average of 4·6, the counts being made each March and April. In a total of 6,058 larvæ from 1,515 cattle, there is an excess of 550 larvæ on the left side over the right side of the cattle examined. A table gives data showing a suggestive correlation between the number of warbles present, and the rainfall for the period April-July of the preceding season.

Control experiments with ointments of (1) iodoform 1 part and soft paraffin 5 parts, and (2) derris powder 1 part, soft paraffin 1 part and olive oil 1 part, were continued and gave excellent results, the former being preferred by the writer. Concerted action is needed.

WALTON (C. L.). **Notes on the Agricultural Zoology of Anglesey.** *Proc. Anglesey Field Club.*, pps. 1–8.

The writer reviews the general conditions and crop acreages of the county, drawing attention to the predominance of grassland, followed in order of importance by oats, swedes and potatoes. The country, in general, is bare and wind swept, woodlands being quite restricted in area; the rainfall for the most part 37–40 inches per annum, and the climate mild. The predominance of grassland, stock raising, and general farming is reflected in the general types of pests and parasites present, which are by no means so varied as in mainland areas of similar extent. The chief worm and insect pests are briefly dealt with, together with recent work done by the Advisory Departments at Bangor.

WALTON (C. L.). **The Agricultural Zoology of N. Wales.**, pp. 1–42, July, 1927.

This pamphlet amplifies the previously issued "Preliminary Report on the Agricultural Zoology of N. Wales" of February, 1924; and deals with the chief pests and parasites affecting Agriculture and Horticulture in the counties of Anglesey, Carnarvon, Denbigh and Flint, as noted by the Adviser in Agricultural Zoology during the period 1921–27.

After a brief account of the work and duties of the Adviser, the acreages under the various crops and numbers of live stock in the different counties are given. Then follow annotated lists of the pests and parasites of Live Stock, Crops, Flowers, Trees and Shrubs, and Fruit. The pamphlet concludes with a list of literature published by the Adviser and research students during the period, and covering 36 titles.

WALTON (C. L.). **Some observations on the Swede Midge in N. Wales.** *Journ. Min. Agric.*, Vol. xxxiv, No. 6, Sept., 1927, pp. 547–551.

This article gives an account of a severe attack of the Swede Midge (*Contarinia nasturtii*) during 1926. An account is given (largely drawn from a Bulletin by T. H. Taylor, of Leeds, issued in 1912) of the Midge and its life history; followed by an account of the pest in N. Wales. The symptoms included (1) leaf crumpling; (2) surface damage to leaf lamina, stalk and blade; (3) distortion of young shoots; (4) death of the leading shoot; (5) double or multiple "necking"; (6) rotting of the crown, neck and bulb. Maximum damage occurred in the lowlands and coastal districts of Carnarvon, the eastern portion of Anglesey, and the Conway Valley. Counts were made in 86 fields and damage ranged up to 90 per cent. of severe stunting, rotting,

etc., in some cases. Variety and sowing date were taken into account and appeared to have little effect, and very variable degrees of infestation were sometimes found near one another. In addition to Swedes, early sown rape suffered severely. Turnips were unaffected. Savoys were damaged here and there.

WRIGHT (N. REES). **On the effects of Exposure to raised temperatures upon the larvae of certain British Mosquitoes.** *Bull. Ent. Res.*, xviii, 1st Sept., 1927, pp. 91–94.

Details the results of experiments designed to fill a hitherto little explored sector of mosquito bionomics, and carried out during the early summer of 1926.

UNIVERSITY OF BRISTOL.

BRITON-JONES (H. R.) & STANILAND (L. N.). **The effects of Strawberry Aphis on the Strawberry Plant.** *Journ. Pom. & Hort. Sci.*, vol. vi, No. 2, June, 1927.

The history of this aphis is given so far as it is known. Infection experiments with *C. fragariae* are described, and these show that a small leaved type of plant having crinkled, cupped and yellow-edged leaves with short thickened petioles results from attacks of this pest. Such plants flower profusely but the fruit is small and of poor quality. The affected plant assumes a flattened appearance and the forcing of lateral crowns occurs as the result of the check to the main crown. Aphis attack before and during the root-forming period (July-December) is shown to lead to a considerable reduction in the amount of root formed. When this occurs, even if no subsequent attack of aphis takes place, the plant and its crop suffer during the following season.

STANILAND (L. N.). **Oil Sprays for Spring and Summer Use** (progress report). *Bath & West Journ*, 1926–27.

The communication is a preliminary one dealing with an investigation in progress to explore the possibilities of using oil sprays as cheap contact washes to replace the use of nicotine.

Both mineral and vegetable oils were considered as to their suitability for the purpose. Ordinary spraying soaps of various consistencies and qualities, castor oil soap, calcium caseinate, soluble casein, saponin, clays and size were tested in turn, with all the oils used, for their suitability as emulsifiers. In the case of the vegetable oils caustic alkalis were tried in order to determine whether or not the oils would emulsify with their own soaps formed by the action with the alkali. This, however, would not take place in the cold.

Rape oil, emulsified in the cold with ordinary soap solution by pouring the oil into the soap solution and then pouring the whole from one container to another several times, was found to be the most satisfactory oil tested.

Rape oil emulsions of various strengths were tested against a number of insects. The results showed that rape gives promise of being excellent as an insecticide.

STANILAND (L. N.). **Experiments on the Control of Apple Capsid Bug.** *Journ. Pom. & Hort. Sci.*, vol. v, No. 4. Oct., 1926.

An account is given of the distribution of the Apple Capsid Bug (*Plesiocoris rugicollis*, Fieb.) and its importance as a pest within the Bristol Province.

Experiments are described in which winter spraying with tar-distillate washes and late lime washing treatment were tested as ovicidal measures. It was found that under favourable weather conditions a good control could

be obtained by the use of tar-distillate washes at 8 per cent. and 10 per cent. strengths, but that lime washing was ineffective in every case.

Experiments designed to test the efficiency of oil sprays and nicotine-soap washes as contact sprays against the bugs in the spring were carried out. While the tests were not of a character to justify any conclusions as to relative efficiency of the washes, it was found that both oil sprays and nicotine soap washes effected a satisfactory degree of control, provided that application was properly timed.

In view of the results further trials are contemplated with the washes.

SCHOOL OF AGRICULTURE, CAMBRIDGE.

Miles (H. W.) & Petherbridge (F. R.). **The Control of Wire-worms in Glass-houses.** *Journ. Min. Agric.*, Vol. xxxiii, No. 10. Jan., 1927.

Experiments which were carried out in glasshouses in Boston, Hatfield and Worthing indicate that wire-worms are readily attracted to suitable bait substances, and out of the baits selected for trial germinating wheat proved to be far the most efficient. Large percentages of the wire-worms assembled at the bait rows were readily killed by means of calcium cyanide.

Petherbridge (F. R.) & Dillon-Weston (W. A. R.). **Trials of Tar Distillate Washes in East Anglia in 1926.** *Journ. Min. Agric.*, Vol. xxxiii, No. 7. Oct., 1926.

These trials were carried out in co-operation with the County Organisers in order to obtain accurate evidence on the value of these washes in reducing the common pests of fruit trees. A fairly accurate but rather laborious method of estimating caterpillar damage was arrived at. All the washes used, except one, gave very useful results in the control of Apple and Plum Aphis, and they gave varying results in the control of caterpillars. There was no control of Red Spider or Apple Scab and very slight control of Apple Capsid Bug.

Petherbridge (F. R.) & Miles (H. W.). **Investigations on the Control of Wireworms.** *Ann. App. Bio.*, 14·3.

Substances and growing plants were tested as baits for wireworm. The experiments indicate that a successful means of control consists of baiting infested land with wheat or oats or a mixture of wheat and beans, and when the wireworms have assembled in the bait row, drilling a suitable poison.

These baits can be used to attract wireworms from crops.

Owing to the seasonal movements of wireworms baiting is best carried out in the autumn or spring.

HARPER ADAMS AGRICULTURAL COLLEGE.

Jary (S. G.). **Trials of Tar Distillate Washes in the West Midlands.** *Journ. Min. Agric.*, Vol. xxxiii, No. 8. Nov., 1926.

This report embodies the results of trials carried out during the winters of 1924–5 and 1925–6. The object was to compare the efficiency of various brands of tar distillate washes in killing the eggs of the commoner insect pests on apples and plums.

In 1924–5 five different brands were used. Three of these were withdrawn from the market in the following year, and their names are not published. Mortegg and carbokrimp, which proved most successful in 1924–5 were used again in 1925–6. These two washes proved very effective, and when used while the trees were completely dormant, produced no ill effects.

On Apples.—Aphides and apple sucker could be reduced practically to nil by as low a concentration as 4 per cent. Winter moth and some species of Tortricid caterpillars were reduced in numbers, but not so completely controlled, and only a 10 per cent. wash gave a reasonable control.

The Apple Capsid Bug was reduced to a considerable degree by 10 per cent. wash.

On Plums.—The leaf curling plum aphis was readily controlled with a 4 per cent. wash. The position with regard to Winter Moth caterpillars is the same as on apples. The development of blossom buds on both plums and damsons was retarded where 8 per cent. and 10 per cent. washes were used.

JARY (S. G.). **Lead Arsenate Spraying—Arsenic Risks in England.** *The Fruit Grower.* Mar., 1927.

Two varieties of apples, Newton Wonder and Lanes' Prince Albert were each sprayed with lead arsenate paste at the rate of 4 lbs. per 100 gallons of water, and 6 lbs. per 100 gallons of water. Spraying was done twice, just previous to and after blossoming.

Random samples of apples were taken monthly from one month after the last spraying and tested by the Gutzeit method for the arsenic on them.

One month after the last spraying the samples showed an arsenic content of about one-ninth the legal standard (·01 grams per 1 lb.) and at the end of the second month it was so low as to be completely negligible. The greater concentration of spray left no more arsenic than the smaller.

The rainfall figures for the district during the period of experiment are appended.

UNIVERSITY OF MANCHESTER.

SMITH (K. M.). **Observations on the Insect Carriers of Mosaic Disease of the Potato.** *Ann. App. Bio.*, vol. xiv, no. 1. Feb., 1927.

The potato, like many other plants, suffers from the attacks of certain infectious diseases of unknown origin, which for want of a better name are called "Virus" or "Degeneration" diseases. Of these disorders, "Mosaic" is perhaps the most widespread if not the most harmful, the symptoms being a mottling, together with a certain amount of distortion, of the leaves. In common with the other virus diseases of the potato such as leaf roll, crinkle, streak, &c., mosaic is spread from diseased to healthy plants by the agency of insects. This paper gives an account of certain preliminary experiments carried out with the object of identifying which of the normal insect fauna of the potato plant are chiefly responsible in nature for the dissemination of mosaic disease. The insects used in these experiments were :—Three species of aphis, two species of leaf-hoppers, two species of capsid bug, and the greenhouse white-fly. All these insects are plant suckers, and belong to the order Hemiptera. The method of procedure in these experiments was briefly as follows :—The insects under test were first fed for considerable periods upon mosaic infested plants, grown in special cages, in order that they might pick up the mosaic virus. They were then transferred to known healthy potato plants which were growing out of doors in insect-proof cages. Each of these healthy plants had a control plant derived from the other half of the same tuber. These control plants were also grown under insect-proof cages, but no insects were allowed to come into contact with them. All plants both control and experimental remained healthy during that season, but the following year Mosaic appeared in the progeny of certain of the experimental plants while the progeny of the controls remained healthy. Evidence is given by these preliminary experiments that two species of aphis are carriers of this disease, while a certain amount of suspicion rests upon the two leaf-hoppers and the white-fly. It does not appear from these tests that the capsid bugs are capable of disseminating mosaic disease.

MIDLAND AGRICULTURAL COLLEGE.

ROEBUCK (A.). **Notes on Hemiptera-heteroptera in the East Midlands.** *Ent. Mon. Mag.* Feb., 1927.

This is a record of the chief species captured during the year.

ROEBUCK (A.). **Some Notes on Insects.** *The Derbyshire Young Farmer.* Apr., 1926.

Notes on Mangel Fly, Cabbage Gall Weevil, Root Maggot on Cabbages and Leatherjackets are given with recommendations for limiting their ravages.

ROEBUCK (A.). **The Use of Poultry against Pests of Fruit Crops.** *Bull. No.* 16, *Midland Agric. Coll.* May, 1927.

This summarises the work of the past few years so far as fruit pests are concerned. All the pests are considered, during each month of the year, so that fruit growers may know what to expect fowls to do at any period of the year. It is pointed out also how pests, otherwise inaccessible to fowls, may be brought within their reach at certain periods of the year. As a further guidance to growers, the serious pests are separated from the unusual or mild pests and the approximate measure of control expected by fowls indicated. In addition, a list is given of those pests against which no direct control by fowls can be expected.

SEALE-HAYNE AGRICULTURAL COLLEGE, NEWTON ABBOT.

HODSON (W. E. H.) & BEAUMONT (A.). **Third Ann. Report of Dept. of Plant Path. for Year ending Sept. 30th, 1926.** *Seale-Hayne Agric. Coll. Pamphlet,* No. 21, 25 pp.

An account is given of the occurrence in 1925–26 in Devon and Cornwall of pests of cereals, forage crops, roots pulse, vegetables, and fruit.

Plots of pyrethrum withstood the winter in the open and yielded an average crop of flowers the following summer. Tests of its insecticidal value showed that it is probably equal to the average French commercial crop.

Experiments carried out to estimate the effect of the attack of *Ceuthorrhyncus Pleurostigma,* Marsh (cabbage gall weevil) on broccoli plants indicated that it is not very harmful unless the galls are particularly numerous, but severe attacks of this weevil in broccoli fields have since been reported, and in one or two instances the almost complete failure of the crop has resulted, apparently entirely owing to this pest.

Since previous introductions of *Aphelinus Mali,* Hald., for the control *Eriosoma Lanigerum,* Hausm., were not entirely successful, another attempt was made. The parasites were bred on infested trees under glass and adults of successive generations were liberated and appear to have become established in three localities.

The life histories of bulb flies attacking narcissus are given with control methods.

HODSON (W. E. H.). **The Azalea Leaf Miner,** *Gracilaria azaleella* **Brants.** *Journ. R.H.S.,* lii, pt. 1, pp. 54–59, 2 pls., 3 refs. London, Jan., 1927.

The Tineid, *Gracilaria azaleella,* Brants, which attacks azaleas, was first noticed in greenhouses in Britain in 1925, and it is undoubtedly increasing rapidly. In the summer of 1926 it was observed out of doors in Devon and it had probably passed the winter in the open. A brief note on its distri-

bution is given, together with a description of the various stages and the nature of the injury caused.

The removal of all injured leaves gives satisfactory control where there are only a few plants. A spray of ½ lb. lead arsenate powder to 10 gals. water is recommended for use out of doors, its efficiency depending entirely on the thoroughness with which the leaves are covered, especially the lower surface, and the length of time that the poison remains on the leaves, the caterpillar being vulnerable only when it seeks a fresh leaf.

Fumigation was also carried out in boxes; the advantages of this method are that leakage of gas is avoided, the removal of a large number of plants from a mixed greenhouse is unnecessary, and the operation can be carried out in the dark even during the daytime. A convenient internal measurement is 5 feet square by 8 feet high, giving a capacity of 200 cubic feet. Well seasoned wood should be used, the joints should be made gas-proof, and the trap doors should be fitted to insure thorough ventilation after fumigation.

Fumigation with tetrachlorethane was successful; ¼ pt. of the liquid to 1,000 cubic feet with a temperature varying from 50°–70° F., fairly dry air, and an exposure of 14 hours, was found to kill all adults and larvæ and some of the more mature pupae. The eggs and many of the pupae, however, escaped, and several fumigations at intervals of 14 days are necessary to eradicate the pest. This liquid is far less dangerous to human beings than cyanide, it is easily stored, handled and measured, and for fumigation needs simply to be poured on to the floor. Provided that the usual precautions are observed and the plants are fairly damp at the roots, scorching need not be feared.

Hodson (W. E. H.). **Some Insect Pests and their control.** *Trans. & Proc. Torquay Nat. Hist. Soc.*, 1925–6, iv, No. 4, pp. 330–334. Torquay, 1926.

Notes are given on a few of the insect pests that proved of considerable economic importance in South Devon in 1925, all of which have been recorded in a report already noticed (R.A.E., A, xiv, 215).

Hodson (W. E. H.). **The Bionomics of the Lesser Bulb Flies, *Eumerus strigatus*, Flyn, and *Eumerus tuberculatus*, Rond., in south-west England.** *Bull. Ent. Res.*, xvii, pt. 4, pp. 373–384, 2 pls., 5 refs. London, June, 1927.

A full account is given of observations on the bionomics of *Eumerus strigatus*, Fall, and *E. tuberculatus*, Rond. (lesser bulb flies) in south-west England, a briefer report of which has already been noticed (R.A.E., A xv, 366). In no case in the experiments under notice were the two species bred from the same consignment of bulbs, and in nearly 90 per cent. of the total cases recorded the damage was attributable to *E. tuberculatus*. It is in the adult stage only that the two species may be separated with any degree of certainty, no reliable distinguishing character having been found in the egg, larval, or pupal stages, which are here described from specimens of *E. tuberculatus*.

An account is given of experiments dealing with the possible effect of injury (particularly by *Tylenchus dipsaci*, Kühn) on the infestation of bulbs by these flies, which showed that uninjured ones may be attacked. Remedial and preventive methods of treatment are discussed (loc. cit.).

SOUTH EASTERN AGRICULTURAL COLLEGE, WYE.

Barnes (H. F.). **The Gall Midges of Vegetables and Market Garden Crops.** *Journ. R.H.S.*, li, pt. 2, pp. 331–336, 4 pls., 6 refs. London, Nov., 1926.

The life-history of *Contarinia nasturtii*, Kieff. (swede midge) is described. Two additional food-plants are marsh watercress (*Radicula Palustris*) and

creeping watercress (*R. sylvestris*). The curling-over of the leaves effectually prevents any spray from reaching the insects feeding beneath. Sowing of the crop should be delayed until the midges of the first brood have emerged and died without being able to lay their eggs, but care should be taken to see that there is no wild food-plant near.

The bionomics of *Perrisia Brassicae*, Winn. (pod midge), which attacks numerous cruciferous crops, are given. No remedy is yet known, but deep-ploughing will destroy overwintering larvæ. It has been found that when summer crops of rape are grown immediately after winter crops there is a great increase of the midge. Additional food-plants are swedes and beets.

Perrisia raphanistri, Kieff, (Colza flower midge) attacks the flowers of a great number of crucifers, such as cabbages, turnips, radishes and colza. Several of the larvæ live together in the flower, causing deformation, which prevents the normal development of the seed. There are at least two generations a year, in spring and summer, the latter generation remaining throughout the winter in the soil. The midge is not usually present in large enough numbers to do much damage, and no control measures have yet been recorded.

Contarinia pisi, Winn (pea midge), lays its eggs in June in pods of peas; less often in those of beans. The larvæ usually live together in batches of 20–40 and feed, apparently, on the inner part of the pod, producing a curious swollen deformity of the pods, and stunting their growth. As many as 300 may be found in one pod; they may also be found among shelled peas and thus lower their market value. Other workers have stated that the life-cycle takes about four weeks; that adults have been obtained in July; and that the winter is passed in the adult stage. In the author's observations, however, the winter was passed in the pupal stage in the soil. In the south of England at least, early peas are seldom infested, the main crops being most heavily attacked. The larvæ of a predacious midge have been found attacking larvæ of *C. pisi* in Kent. All infested plants should be burnt as soon as the crop is gathered, and the land should be trenched and rolled in the autumn and winter, and only top-worked in the following spring.

The larvæ of *Pezomyia speyeri*, Barnes (mushroom midge), which are not gregarious, feed on the mycelium of mushrooms grown under glass. The pupæ may be found a little below the surface of the mushroom bed. This midge has not been known to occur in sufficient numbers to be regarded as a serious pest.

Perrisia bryoniae, Bch., which is a pest of vegetable marrow in France, occurs in Great Britain on white bryony (*Bryonia dioica*). Several of the larvæ live together in clusters of malformed leaves at the extremities of the shoots, which they deform. They are in the shoots in June and July; the pupal stage lasts about 8–14 days, and the adults emerge in July. There is probably another generation in the late summer and autumn, which pupates in the soil during the winter months.

Kiefferia pimpinellae, Lw., and *Macrolabis corrugans*, Lw., are pests of parsnips in France, but although they are fairly common in Britain on wild umbellifers, and have been recorded on parsnips, they have not yet become pests. The larvæ of both these midges pupate in the soil. A list of their food-plants is given.

Barnes (H. F.) & Theobald (F. V.). **A new Gall Midge attacking *Arabis albida*.** *Journ. S.E. Agric. Coll.*, No. xxiv, pp. 54–55, fig. 1, July, 1927.

The Cecidomyiid fly *Dasyneura albida*, Barnes (n.sp.) here described from Surrey, destroys the whole central growth of *Arabis albida*, an important bedding plant. The damage was so extensive in one garden that all the stock had to be burnt. Four ounces of napthalene to the square yard is

recommended to clean the soil of the pupating insects after the plants have been burnt.

BARNES (H. F.). **Material for a Monograph of the British Cecidomyidae or Gall Midges. British Gall Midges of Economic Importance.** *Journ. S.E. Agric. Coll.*, No. xxiv, pp. 65–146, 11 pp. refs., July, 1927. (Reprints 3/6).

A complete compilation of the available information on the British Gall Gnats of economic importance. This monograph incorporates much new information not previously published. It is in five parts, the author dealing with the species attacking cereals, fodder crops, vegetables, fruit, hops, violets, roses and chrysanthemums. Full details of each species are given and the original or first available description of each species also. An account of the life-history, natural enemies, economic importance and the control is also included.

BARNES (H. F.). **New Damage to Peas by the Pea Midge.** *Journ. Min. Agric.*, Vol. xxxiv., No. 2, pp. 159–161, 1927.

A new attack of the Pea Midge (*Contarhinia pisi*, Winn.) is given, the shoots of flowers being attacked. Two generations of the Pea Midge are shown to occur. Mature larvae were found in the pea flowers in the third week in June and some adults also found laying their eggs in the terminal shoots. Soon after the first week in July the larvae leave the flowers and fall to the earth, the following brood laying eggs in the pods. The attack on the flowers is shown to be much more serious than that on the pods. Measures recommended are hand-picking the damaged flowers and shoots and soil fumigation between the rows with napthalene at the rate of 3 cwt. to the acre.

BARNES (H. F.). **Four British Aphid eating Gall Midges.** *Entomologist.* lx, pp. 174–180, lx, pp. 174–100, 1, 1927.

A description of four species of Gall Midges belonging to the genus *Phaenoremia* Kieffer reared from larvae feeding on four different species of Aphides in Great Britain, viz. on *Macrosiphum rosae* var. *glauca*, *Anuraphis roseus*, *Phorodon humuli* and *Anuraphis helichrysi* (*padi.*). The species recorded are (1) *P. meridionalis*, Felt; *P. rosae* Barnes; *P. helichrysi*, Barnes, and *P. macrorosae*, Barnes.

BARNES (H. F.). **British Gall Midges. I.** *Ent. Mon. Mag.*, lxiii, pp. 164–168, July, 1927 and pp. 169–172, Aug., 1927, and lxiii, pp. 211–216, Sept., 1927.

A technical account of two Gall Midges *Pezomyia speyeri* Barnes compared with *Mycophila fungicola*, Felt, a mushroom feeder *Aprionus miki* Kieff in rotten wood; *Colonyia hordei* Barnes from Barley; *Dasyneura agropyronis* Barnes on *Agropyron repens* and *Dasyneura medicaginis* Rubs on Clover.

DUFFIELD (C. A. W.). **The Beet Eelworm** (*Heterodera schachtii*). **Its life-history when found in the Hop in this country.** *Journ. S.E. Agric. Coll*, No. xxiv, pp. 50–58, July, 1927.

Observations carried out at weekly intervals over a period of three years showed that the life-history of *Heterodera schachtii* on hops in Great Britain, where there is only one generation a year, differs considerably from that on the Beet-root on the Continent, where there are several generations. The result of observations and varied counts showed that this worm had nothing to do with the cause of Nettle-head in hops, as previously supposed.

DUFFIELD (C. A. W.). **The Blossom Beetle (*Meligethes aeneus*) attacking the Seed Crop of Swedes, etc.** *Journ. S.E.Agric. Coll.* No. xxiv, pp. 59–63, 9 refs, July, 1927.

Severe losses have been caused in all localities where swedes are grown for seed in Britain, particularly in parts of Kent and also in other countries by the insects attacking the flowers; in one case in 1922 damage was estimated at £30 per acre over 25 acres of seed. Three insects affect the seed production in cruciferous root crops, the Blossom beetle, the Seed Weevil (*Ceutirrhynchus assimilis* and the Seed Midge (*Dasyneura brassicae*). The paper deals only with the first, the various stages and nature of damage are described and discussed. The adults hibernate in rubbish, haystacks and stubble or just below the ground. They swarm out the first warm weather in April or May and are first found in the flowers of Daffodils and other bulbs, then on Charlock and wild Crucifers and finally on the blossom buds of swedes. Spraying with arsenate of lead and Paris green proved useless. Paraffin as a repellant gave better results, but the best results were obtained by mechanical methods; the most successful instrument being a piece of board with a half circle cut out on one side enabling it to be fitted round the plant, with handle fixed to it and smeared with sticky paper, the beetles being shaken off on to it.

THEOBALD (F. V.). **The Diamond Back Moth (*Plutella maculipennis*).** *Journ. Kent Farmers' Union*, xx, No. 3, reprint, 7 pp., 1 fig. Maidstone, Sept., 1926.

Plutella maculipennis, Curt. (diamond-back moth) is always present to a certain extent in Britain and in certain years causes serious losses. Earlier records in this country are briefly reviewed. In 1926 the pest was abundant in Kent, particularly on the coast of Thanet and also in some localities inland, many acres of swedes having to be resown, while other crucifers, both wild and cultivated, were also seriously injured. There are at least two generations a year in Britain and sometimes three, the first moths appearing in May and June, and ovipositing on cruciferous weeds, the second generation ovipositing in July on cultivated crucifers, and hibernating as pupæ. One female may deposit from 70 to 100 eggs, which hatch in 7–10 days, the larval stage lasts from 16 to 24 days. The best remedy is to brush as many as possible of the larvæ off the plants by mechanical means such as boughs attached to a horse hoe, and follow this treatment with a nicotine or lead arsenate spray or dust. A home-made pyrethrum spray has also given promising results.

THEOBALD (F. V.). **Notes on some unusual Insect Pests on Fruit.** *Journ. Pom. & Hort. Sci.*, v, No. 4, pp. 241–247, 6 figs. London, Oct., 1926.

The larvæ of *Mania maura* (old lady moth), which is commonly found in England, particularly along the Thames Valley, are recorded as eating off the shoots and buds and the bark from the shoots of plums, peaches and nectarines. This species, the stages of which are described, is polyphagous, and only occasionally attacks fruit trees. The moths are sometimes attracted to lights and shelter in dark places by day. The female oviposits in late summer and autumn, usually on fruit trees; the eggs hatch in autumn and the larvae enter the soil and hibernate, but may, as in the present case, feed at times during the winter, emerging from the soil at night only. In the spring, they remain above ground and feed on the leaves, but the chief damage done is to the buds, shoots and wood in late autumn and winter. Larvae kept in the insectary continued feeding until May, when they descended to the soil for pupation. Pear trees are sometimes attacked, but apple and cherry only in the absence of other food. Numbers of the larvæ

can be killed by prong-hoeing round the stems of the trees during the day, and crushing those that remain exposed but undamaged.

The earwig, *Forficula auricularia*, was observed to eat out the unopened blossoms and buds of plums. On some young trees up to 90 per cent. of the buds were damaged and showed scarcely any blossom. The old established trees were not much affected. The earwigs were found in numbers sheltering under the bands of sacking round the trees, and the damage can easily be checked by untying the bands and holding beneath them a circular piece of cardboard made into a funnel and smeared inside with adhesive, in which most of the insects can be caught.

Two species of thrips, *Thrips tabaci* and *T. flavus*, caused serious loss in a plantation of American blackberries, about 50 per cent. of the blossoms and young fruitlets being destroyed. A small proportion of the damage was due to *Byturus tomentosus* (raspberry beetle) and to the gall midge, *Contarinia rubicola*. Both larvae and adults of these thrips feed in the blossoms, and eggs are laid in the petioles. The nymphal stage is passed in the soil. *T. adusta* was also present, and small numbers of *Limothrips Cerealium*. *T. tabaci* and *T. flavus* evidently pass the winter in the adult stage, and were first observed on blackberries in June, the chief attack coming from the second generation in August and early September. They were found in numbers in wild blackberry blossoms in the neighbourhood, and occasionally in loganberries, but not in raspberries. Spraying is useless, as the thrips are hidden in the buds and flowers, and would only be dangerous to bees. Poultry allowed to run in the plantation ate the adult thrips as they escaped from the soil, and succeeded in clearing up the infestation in question, which, however, continued in the neighbouring wild blackberries.

THEOBALD (F. V.). **Some Soil Insects and Their Treatment.** *S.E. Agric. Coll., Res. & Adv. Dept. Bull.*, 5, 6 pp. Wye, Kent, Jan., 1927.

A popular account is given of the chief soil insects attacking crops and the methods used for their control. *Tipula oleracea*, L. (common crane-fly), *T. paludosa*, Mg. (marsh crane-fly), and *Pachyrrhina maculosa*, Mg. (yellow-spotted crane-fly) occur in fields and gardens and on roadsides in summer, particularly in damp and badly drained spots, and are perhaps more prevalent in grass than arable land. The eggs are laid in the soil or on the surface of grass land. The larvae feed through the winter, remaining below ground during the day but coming to the surface at night, especially when it is warm and damp. The pupa forces its way partly out of the soil, and the adult emerges some time between May and September. The larvæ attack root crops, cereals, garden produce, strawberries and grass.

A poison bait made by mixing 1 lb. Paris green with 1½ bushels bran and made into a fairly dry mash is recommended. This amount (or better still, two bushels) to the acre should be broadcast towards evening, and works best if used on a warm, damp night. Finely crushed crude or commercial napthaline, broadcast at the rate of 2 cwt. to the acre and ploughed or dug in, may also be used; it is most effectual when followed by rain. This substance may, however, be harmful in bright light, especially to seedlings, and is known to damage strawberries.

Cutworms, especially the larvæ of *Feltia* (*Agrotis*) *exclamationis*, L. (heart and dart moth) and *Euxoa* (*A.*) *segetum*, Schiff. (turnip moth), attack root crops, potatoes, cereals and many garden plants. The moths appear in June and July and lay their eggs in clusters on leaves near the soil or actually on the soil. The larvae eat into potato tubers and feed throughout the winter, pupate in early summer and emerge about two weeks later. They may be controlled by the above-mentioned poison bait or, in potato fields, by allowing poultry to run there when the potatoes are being lifted.

The grubs of *Melolontha* L. (*vulgaris*, F.) *Amphimallus* (*Rhizotrogus*) *solstitialis*, L., and *Phyllopertha horticola*, L., feed on the roots of all plants, but prefer grassland. They live in the soil for three years, two years and one year respectively. Napthaline will destroy these pests where it can be ploughed or dug in, but in grassland, only very heavy rolling has been found effective.

Wireworms take from 3–5 years to mature, and they feed during the greater part of this time on roots, potato tubers, etc. They usually work near the surface of the soil. The beetles prefer land thickly covered with vegetation for oviposition, so that the larvæ are most abundant in permanent pasture and clover ley. Control measures are: drilling artificial manure with the seed; heavy ring-rolling both ways: the use of napthaline or some other soil insecticide; and trapping the beetles in heaps of clover or lucerne covered with tiles or boards in May, June and July, and burning the heaps every ten days. When grassland or clover ley is being broken up, it is advisable to turn sheep into the field, later giving a dressing of naphthaline and ploughing it in. If possible, it is best to grow a first crop of mustard and to graze sheep on it.

THEOBALD (F. V.). **A New Aphid Genus and two new Species.** *Entomologist*, lx, No. 765, pp. 31–34. London, Feb., 1927.

The species described are *Mycetoxoptera wimshurstae*, gen, et sp. n., from bitter cress (*Cardamine hirsuta*, in Kent; and *Periphyllus horridus*, sp. n., from sycamore in Somerset.

THEOBALD (F. V.). **Two New Aphids from Ants' Nests.** *Ent. Record & Journ. Var.*, xxxix, No. 2, pp. 17–18, 1 pl. London, Feb., 1927.

Paracletus donisthorpei, sp. n., from the nests of *Tapinoma nigerrima* and *Anuraphis siciliensis*, sp. n., from the nests of *Cremastogaster sordidula* are described from Sicily.

THEOBALD (F. V.). **Three New British Aphides.** *Ent. Mon. Mag.*, lxii, No. 746, pp. 162–165, 3 figs. London, July, 1926.

The new Aphids described are *Aphis triglochinis* on *Triglichin maritimum* and *Anuraphis prunifex* on *Prunus spinosa* from Kent, and *A. sherardiae* on *Sherardia arvensis* from North Wales.

THEOBALD (F. V.). **Insects Caught in Light Traps.** *Journ. R.H.S.*, li, pt. 2, pp. 314–323, 3 pls. London, Nov., 1926.

Experiments were carried out with light traps for two years to ascertain whether a sufficient quantity of male winter moths (*Cheimotobia brumata L.*) could be caught to stop fertilisation of females, and whether Tortricids are attracted in large numbers. One Medusa acetylene light trap was used for nine months and two for fifteen. These were placed in a mixed fruit plantation, consisting of apples, currants, nuts, and a few plums, and near pears, loganberries, American blackberries and strawberries. The traps failed as a means of catching male winter moths, but the numbers of Tortricids caught were large enough to warrant an extended trial.

The trays holding oil and water should be removed as soon after sunrise as possible, otherwise hive bees may be drowned in them. Water should not be used without oil or some of the moths caught may escape. The height of the lamp from the ground does not seem to affect the number of insects caught. Most moths are caught between sunset and one o'clock. General observations seem to show that one lamp to an acre is sufficient.

The length of time that some of the insects recorded are on the wing is shown to be much longer than is generally supposed, *e.g.*, *Tortrix podana*, Scop., 25th June—31st August; *Abraxas grossulariata*, L., 24th July—2nd September; and *Tortrix rosana*, L., June—September.

The total number of insects caught in the two years was 9,977, of which 3,220 were definitely identified as pests, including 1,625 injurious Tortricids, 368 winter moths and 594 injurious Tipulids. Eight hundred other Tortricids were too badly damaged to be identified. Practically all moths caught from October to March were males, with the exception of *Diloba coeruleocephala*, L., of which 10 per cent. were pregnant females. During the summer, 45 per cent. of the Agrotine moths were females in one year, and only 7 per cent. in the other: 50 per cent. of the Tortricids, 45 per cent. of the Crambids, and 27 per cent. of the Tipulids were females. On several nights the oil in the trays was covered with the eggs of these insects. The plantation in which the traps were set was not badly attacked by any pests except sawflies, so that no large catches were expected.

The insects caught included very few beneficial ones. A list of the species is given, with tables showing the months in which they were caught. A light trap would probably only be of practical value during June, July and August: the cost of running one for this period is about 10s.

Theobald (F. V.). **The Plant Lice or Aphididae of Great Britain.** Vol. i, 372 pp., 196 figs. London & Ashford, Kent, Headley Bros. 1926. Price £1 1s. net.

This is the first volume of a monograph that is the result of 26 years' study of the Aphids of the British Isles. In naming the species reference has been chiefly made to Buckton's Monograph of British Aphides of 1875–1884. The original descriptions are quoted of all those species that appear to be valid, although the author has not seen them. In the case of Walker's species, the types of some of which are lost, only those that seem recognisable without the types are reproduced. The systematic aspect only of the *Aphidae* is dealt with, except that what is known of the life-cycle of any species is included with its technical description. The *Phylloxeridae*, including the genera *Phylloxera* and *Chermes* (in the broad sense), are regarded as separate from the true Aphids and are not included. The classification largely follows that of Baker in America, which is considered the simplest and most rational, though any classification is as yet very uncertain.

The new species described are *Myzus laricellus*, on larch; *M. polyanthi*, on polyanthus, primrose, auricula, &c.; *M. Erigeroniella*, on fleabane (*Erigeron acris*); *Rhopalosiphoninus pseudo-rumicis*, on docks; *R. lupulinus*, on hops and wild strawberry (*Fragaria vesca*); and *Amphorophora hieraceoides*, on *Hieracium* sp. New names are *Macrosiphum githargo* for *Siphonophora cichorii*, Buckt. nec Koch; *Capitophorus gillettei* for *Rhopalosiphum hippophaes*, Gill. nec Koch; *Myzus pseudolamii* for *Macrosiphum lamii*, Theo. nec v. d.G; *Myzus veronicellus* for *Macrosiphum veronicae*, Theo.; and *Myzus neogei* for *M. gei*, Theo. nec Koch. *Neomyzaphis*, gen. n., is erected for *Aphis abietina*, Wlk.

Theobald (F. V.). **Capsid Bugs (Capsidae) on Fruit Trees.** *Journ. Kent Farmers' Union.* xxi, No. 6, 1927 & *Reprint*, pp. 7, figs. 3, July, 1927.

Deals with the general life-history of the Capsid Bugs attacking fruit trees, especially the Green Apple Capsid (*Plesiocoris rugicollis*) and the distribution in the S.E. Province. Also possible preventive methods including winter spraying and nicotine-soap summer spraying. Especial notice is taken of the fact that many insects fall in spraying and may be caught re-ascending the trees in grease bands.

THEOBALD (F. V.). **The use of Tar Distillate Washes. But still the necessity for grease-banding.** *Journ. Kent Farmers' Union.* xxi, No. 4, pp. 110–114, Oct., 1927.

The general use of Tar Distillate washes is gone into, showing the benefits derived by the winter destruction of Apple, Plum and Currant Aphides and also the Apple Sucker. The failure against eggs of Red Spider and Capsids is pointed out and the only partial success against the ova of the Winter Moths. Thus whilst pointing out the great benefit of Tar Distillate Washes the necessity of continuing grease-banding is still advocated so as to control the Winter Moth.

THEOBALD (F. V.). **The Plant Lice and Aphididae of Great Britain.** vol. ii, pp. 411, fig. 182 (Headley Bros, Ashford, Kent). Price 30s.

This second volume of the Plant Lice of Great Britain deals with the remainder of the *Aphidina* and the *Callipterina, Drepanosiphina, Phyllaphidina* and *Monaphidina.* One new genus (*Neocaudus*) is described and seven new species, or with new names. All the British species so far known are included and the life-histories, localities and food plants given. A long account is given of the Leaf Curling Plum Aphid and its true name shown to be *Aphis padi,* Linnaeus; also of the Mealy Plum Aphid (*Hyalopterus arundinis*). The work is illustrated with structural drawings of the various species and photographs of the damage caused by them. Many of the insects are shown to have a world-wide distribution.

THEOBALD (F. V.). **An Attack of Cockchafer Larvae on Grassland and some experiments in connection with their control.** *Journ. S.E. Agric. Coll.*, No. xxiv, pp. 40–43, 1 fig., July, 1927.

An account of great damage done by Chafer larvae to grassland in Kent, the species proving to be *Melolontha vulgaris.* Experiments with napthalene, kainit, acetylene waste and gas lime were not successful even when applied at the rate of 6 cwt. to the acre. Neither kainit nor napthalene had any appreciable effect on the larvae (though the former stimulated the recovery of the grass in winter); they also had a repellent effect on birds which are the chief natural enemies. Mechanical measures proved more effective and cheaper; the land was rolled in October with a steam roller which destroyed 70–100 p.c. of the grubs. The cost amounted to 10s. per acre.

THEOBALD (F. V.). **Caterpillars and Plant Lice attacking Chrysanthemums under glass.** *Journ. S.E. Agric. Coll.*, No. xxiv, pp. 44–50, figs. 4, July, 1927.

A short account of the Lepidopterous larvae and Aphides that attack Chrysanthemums under glass. The Angle Shades Moth (*Brotolomia meticulosa,* Linn.) is shown to be becoming more and more destructive, the broods overlapping; and adults appear through the winter. Damage by the larvae of *Polia oleracea* L. and *Euxoa segetum* is also detailed and references given to *Naenia typica.* Seven species of Plant Lice are shown to be harmful in varying degrees including *Macrosiphoniella sanborni, Macrosiphum lineatum, Mygus persicae, M. duffieldii, M. circumflexus, Anuraphis helichrysid* and *Aphis rumicis.* Treatment recommended for the moths is the employment of bottles of sweetened baits and tobacco fumigation and nicotine soap spraying for the Plant Lice.

THEOBALD (F. V.). **Scarcity of Aphides in 1924 in Southern Britain.** *Journ. S.E. Agric. Coll.*, No. xxiv, pp. 51–53, July, 1927.

In the Autumn of 1923 sexual forms of various Aphids were abundant in South England suggesting the possibility of a heavy infestation in 1924.

Unfavourable weather prevailing in late winter and early spring was responsible for a very high mortality among the young aphides and no serious attack took place in 1924.

THEOBALD (F. V.). **Notes on British Aphides with descriptions of two new species.** *Ent. Mon. Mag.*, lxiii, pp. 30–34, Feb., 1927.

This paper deals with the description of a New Aphis on Iris—*Aphis newtoni* and a species from Oats *Salturaphis ornatus*; a reference to a currant Aphid new to Great Britain found in Wales (*Rhopalosiphoninus ribesina* V.d. Goot); and references to *Amphorophora rhinanthi* Schouteden; *Macrosiphum lineatum* V.d. Goot, *Anuraphis ranunculi* Kaltenbach on Dock and Ranunculus roots in Wales and the Rosy Leaf Curl Apple Aphid *Anuraphis crataegi* Kaltenbach) on apples.

NORTH OF SCOTLAND COLLEGE OF AGRICULTURE.

RENNIE (J.). **Acarine Disease in Hive Bees.** *North of Scot. Coll. of Agric. Bull*, 33. Aberdeen, Milne & Hutchison. 1927.

A pamphlet of 34 pages with plates describing the disease, the progress of infestation, the factors affecting the course of the disease within the colony, the symptoms and the control of the disease.

MINISTRY OF AGRICULTURE AND FISHERIES, PATHOLOGICAL LABORATORY.

FRYER (J. C. F.) & STENTON (R.). **Pyrethrum Growing for Insecticidal Purposes.** *Journ. Min. Agric.*, Vol. xxxiii, No. 10, pp. 916–920, 2 pls. Jan., 1927.

The properties of pyrethrum as an insecticide are discussed, and a brief history of its cultivation is given. Preliminary experiments on pyrethrum-growing in England have been made, and the results have been successful enough to warrant their continuation.

FRYER (J. C. F.). **The Control of Horticultural Pests—A Retrospect.** *Essex County Farmers' Union Year Book, reprint*, 5 pp. Chelmsford, Feb., 1927.

This is a very brief and popular account of the development of spraying for the control of insect pests since 1913 in England, and of legislation to prevent their importation. There is no doubt that better control is now being exercised, but other changes are tending to render both insect pests and fungous diseases of greater importance. It is suggested that if the same progress is made in the next fifteen years it should be sufficient to meet the increasing demands of horticulture.

(6) MYCOLOGY.

HORTICULTURAL RESEARCH STATION, EAST MALLING, KENT.

AMOS (J.), HATTON (R. G.) & MACKENZIE (A. D.). **The Incidence of Die-back Disease on Plum Trees in the Field.** *Ann. Report, East Malling Research Station,* ii, Supplement. Mar., 1927.

Observations on 6 acres of Plum Trees consisting of 12 varieties on some 15 different rootstocks suggest :—

1. That whilst the attack of "die-back" takes place more or less indiscriminately upon any root stock, the susceptibility of scion varieties is markedly different.

2. That the distribution of the disease appears to have no relation whatever to its situation upon the plots. On the other hand, stock and soil have obviously played an even lesser part.

AMOS (J.) & HATTON (R. G.). **Reversion in Black Currants. I. Symptoms and Diagnosis of the Disease.** *Journ. Pom. and Hort. Sci.,* Vol. vi, No. 3, p. 167.

The leaf characters of Normal and Reverted bushes are discussed in detail, in relation to varietal differences, to the position of leaves on the shoot, and to different types of leaf.

The veining and serration of leaves are recommended as the only sure diagnostic characters for "roguing."

The causes of "false" reversion and methods of distinguishing it from true reversion are described.

Other less constant characteristics of reverted bushes, such as nettle-headedness, character of flowers, and non-cropping are described as additional aids in diagnosis of the disease.

Series of experiments on various aspects of this work are described in detail, and the figures and measurements are presented.

HARRIS (R. V.). **A Wilt Disease of Hops.** *Ann. Report, East Malling Research Station,* ii, Supplement. Mar., 1927.

A wilt disease of hops is described with symptoms differing in certain respects from the symptoms of Hop Canker as described by Salmon and Wormald (Journ. Min. Agric., July, 1922).

A species of *Verticillium* was constantly isolated from diseased bines but inoculations of healthy bines with pure cultures of this fungus had up to the time of writing yielded negative results.

Certain precautionary measures against the spread of the disease are suggested.

WORMALD (H.). **A Disease of the Shasta Daisy.** *Ann. Report, East Malling Research Station.* Mar., 1927.

A popular account is given of a disease which was first recorded for Britain in the "Gardeners' Chronicle" (Oct. 31st, 1925), the original article being abstracted in the Review of App. Mycol., Feb., 1926.

WORMALD (H.) & HARRIS (R. V.). **Bacterial Rot of Turnips.** *Ann. Report, East Malling Research Station.* Mar., 1927.

A popular account is given of the soft rot of turnips and other vegetables caused by *Bacillus carotovorus* and the article gives a summary of results previously recorded in the Ann. App. Bio. and abstracted in the Review of App. Mycol., Vol. v, pt. i. Jan., 1926.

WORMALD (H.). **A Leaf Blotch of Quince Trees.** *Ann. Report, East Malling Research Station.*

This is a popular account of the disease; it is also a résumé of an article published in the Trans. Brit. Mycol. Soc. and abstracted in the Review of App. Mycol., Vol. v, No. 7. July, 1926.

WORMALD (H.). **Notes on Plant Diseases in 1925.** *Ann. Report, East Malling Research Station.* Mar., 1927.

This is a report on plant diseases observed during the year 1925 at the East Malling Research Station and on specimens sent in by growers asking advice. Various fungous, bacterial and virus diseases, chiefly relating to horticultural crops, are noted.

WORMALD (H.). **Further Studies of the Brown-rot Fungi. II. A contribution to our knowledge of the Distribution of the Species of Sclerotinia causing Brown-rot.** *Ann. Bot.*, Vol. xli, No. 162, April, 1927

The present distribution of the common brown-rot fungi so far as has been ascertained from the literature on the subject and a study of strains collected by the writer, is as follows:—
Sclerotinia fructigena: Europe, Japan, Manchuria; *Sclerotinia cinerea f. pruni*: Europe, the Pacific Coast of North America, Manchuria and (according to Takahashi) a form of S. cinerea occurs on various species of Prunus in Japan.; *Sclerotinia cinerea f. mali*: Great Britain and Ireland (and probably the Continent); *Sclerotinia americana*: the United States, British North America, Australia and New Zealand.
The economic significance of this distribution is discussed.

WORMALD (H.). **Canker in Fertility Pear Trees.** *Journ. Min. Agric.* Vol. xxxiv, No. 2, May, 1927.

An outbreak of Canker (*Nectria galligena*) in Fertility pear trees at East Malling was associated with Scab (*Venturia pirina*), and the conclusion is that the canker fungus invaded the branches through the scab lesions. The disease was far worse on standard trees than on bush trees. Growing this variety of pear as a regularly pruned bush is recommended as a means of reducing canker.

WORMALD (H.). **Brown Rot of Apples. The Need for careful Picking and Sorting.** *Journ. Min. Agric.*, Vol. xxxiv, No. 6, Sept. 1927.

It is pointed out that infection of apples by the brown rot fungus *Sclerotinia fructigena*, takes place readily at the stalk end, when the fruit is picked *from* the stalk instead of *with* the stalk. Careful picking and handling of the fruit, to avoid unnecessary mechanical injury during the operations of grading, packing and storing, are advised, in order to reduce infection by this fungus.

WORMALD (H.). **Brown Rot Diseases of Fruit Trees in 1926.** *Gard. Chron.*, Sept. 17th, 1927.

The Brown Rot diseases caused by *Sclerotinia fructigena* and *S. cinerea* were very prevalent during 1926. Blossom wilts caused by *S. cinerea* were common in spring, favoured by the wet weather experienced. Infection by *S. fructigena* in summer and autumn caused much rotting of fruit, not only in apples and pears, but also in plums.

EXPERIMENTAL AND RESEARCH STATION, CHESHUNT.

SMALL (T.). **Rhizoctonia "Foot-Rot" of the Tomato.** *Ann. App. Bio.* Vol. xiv, No. 3, Aug., 1927.

This disease, caused by *Rhizoctonia solani* (Kühn), is occasionally responsible for considerable losses in Guernsey. It appears shortly after planting in the glass-houses, and results in the formation of brown lesions on the stem at soil level, which extend and cause the plant to fall over.

Investigation showed that the disease is most destructive between 16° and 20° C, and especially on wet, clay soil, or soil rich in stable manure. It was alleviated by a top dressing of ammonium sulphate, but apparently unaffected by lime, potassium sulphate, and superphosphate.

An attempt was made to find a fungicide which would enable the grower to re-plant infected areas at once. Many substances were tested including Cheshunt Compound, copper sulphate, sulphuric acid, formaldehyde, uspulun, ammonium sulphate, ammonium polysulphide, and ammonium carbonate, but only uspulun was effective. In a final test with this fungicide 13 out of 16 plants remained healthy whilst all the controls were severely attacked.

To control the disease during the season affected plants should be carefully uprooted and the area treated with uspulun (1 in 400), after which it may be re-planted and a dressing of ammonium sulphate given. Dry, open soil conditions should be maintained by periodic hoeing and, if possible, by reducing the water supply and raising the temperature. The practice of furrow planting is to be deprecated on nurseries infected with *R. solani*.

At the end of the season, soil sterilisation by heat is the most effective and reliable means of eradicating the disease. Numerous fungicides were tried, but in no case was the soil freed from disease. Cresylic acid (0.36 per cent.), lysol (0.08 per cent.), potassium dichlorphenol (0.056 per cent.), copper sulphate (1.32 per cent.), flowers of sulphur (0.5 per cent.), and potassium permanganate (0.27 per cent.), were almost useless. Formaldehyde (0.25 per cent.), phenol (0.22 per cent.), potassium dichlorcresylate (0.032 per cent.), potassium dichlorphenate (0.065 per cent.), and ammonium carbonate (0.88 per cent.), checked the disease, but the treatment was considered too costly for use on a commercial scale and, in addition, was less reliable than heat sterilisation.

ROTHAMSTED EXPERIMENTAL STATION.

BRIERLEY (WM. B.), JEWSON (S. T.) & BRIERLEY (M.). **The Quantitative Study of Soil Fungi.** *Trans. Intern. Congress Soil Sci.*, Washington, 1927.

The technique of the quantitative study of soil fungi has been divided into its several steps and each of these analysed into its component factors as follow:

A. Factors of Sampling.—(I) Methods of sampling; (II) amount of sample; (III) depth distribution of fungi in relation to sampling; (IV) storage of samples; (V) comparison of samples.

B. Factors of Suspension.—(I) Sampling of sample for primary suspension; (II) shape of container; (III) suspension liquid; (IV) standing of suspension.

C. Factors of Disintegration.—(I) Method of disintegration; (II) violence and duration of shaking.

D. Factors of Dilution.—(I) Method of dilution; (II) degree of dilution.

E. Factors of Plating.—(I) Method of plating; (II) number of plates; (III) size of plates; (IV) amount of medium; (V) composition of medium; (VI) acidity of medium; (VII) competition on plates.

F. Incubation Factors.—(I) Period of incubation; (II) temperature of incubation.

G. Counting Factors.—(I) Method of counting.

Each individual factor has been analysed both singly and in relation to other factors and as far as possible standardised.

CROWTHER (E. M.), GLYNNE (M. D.) & ROACH (W. A.). **Sulphur Treatment of Soil and the Control of Wart Disease of Potatoes in Pot Experiments.** *Ann. App. Bio.*, Vol. xiv, No. 4, Nov., 1927.

In a series of pot experiments on potatoes grown in an acid soil artificially infected with wart disease fungus, treatments with sulphuric acid and various combinations of sulphur and calcium carbonate, yielding a wide range of soil reaction, gave almost complete freedom from infection when the acidity of the soil had been raised to a very high value (pH 3·4 or less). Heavy dressings of calcium carbonate, alone or with sulphur, giving a soil reaction of pH 7·5 or more, also reduced infection.

DICKINSON (S.). **Experiments in the Physiology and Genetics of the Covered Smuts of Oats and Barley. Hyphal Fusion.** *Proc. Roy. Soc. B.* CI. B708. 1927.

The cytology of the covered smuts of oats and barley in pure culture has been investigated, and the fusion, both within and across the species investigated between the mycelia of different 'gender' derived from single sporidial isolations, is described. The fusion hypha is binucleate, and nothing has been seen which suggests that nuclear fusion occurs. The binucleate fusion-hypha gives rise to uninucleate hyphæ which are of different gender, these being produced at different ends of the fusion hypha.

DICKINSON (S.). **Experiments on the Physiology and Genetics of the Smut Fungi.—Seedling Infection.** *Proc. Roy. Soc., B*, Vol. 102, 1927.

Experiments are described which show that no infection of oat or barley seedlings by pure cultures of smut fungi occurs when one gender(sex) is present, but when, under similar conditions, two genders are present, 90 per cent. infection and over is obtained.

MCLENNAN (E.). **The Growth of Fungi in Soil.** *Ann. App. Bio.*, xv, 1, 1928.

Sterile soil was inoculated with a known quantity of spores of four different fungi, incubated at 9°C, and at intervals representative samples were plated out by the dilution method and an analysis of the plate population made. Results showed that high plate counts were not in any way connected with vegetative growth and supported Conn's idea that in such a case one is simply measuring the sporing capacity of the forms used.

Samples of moist soil and of soil which had been dried in a vacuum desiccator over calcium chloride were plated out by the dilution method and the number of fungal colonies per plate compared. A marked decrease was noted with the dried sample. The reduced pressure was found to have no effect as drying under ordinary air-pressure gave comparable results.

Suspensions in soil, and in sand, of fragmented mycelia and of a mixture of fungal spores, were in turn plated out directly and after drying. No colonies developed from the sample in the desiccator containing only mycelia, whereas the sample containing spores was in no way affected. It is suggested therefore that the decrease obtained after drying is due to the desiccation of the vegetative mycelium in the soil and since the reduction in the number of colonies per plate is very pronounced after this treatment, it is thought that the normal fungal constituents of the soil are present extensively in the mycelial condition.

ROACH (B. M. BRISTOL). **Methods for use in studying the algae of the Soil.** *Handbuch der biologischen Arbeits-methoden.* 1926.

Details are given of a cultural method for estimating roughly the numbers of algæ (Chlorophyceæ and Diatoms only) in the soil. Methods are also described for the isolation and cultivation of soil algæ in (*a*) impure and (*b*) pure cultures, and suitable media are recommended for use. An account is given of a special method for estimating quantitatively the effect of any condition or chemical compound on the rate of growth of a unicellular soil alga, the rate of growth being regarded as an index of the metabolism of the organism.

Methods are also described for studying the biochemical activities of pure cultures of algæ under the following headings:—(1) Decomposition of protein (gelatine). (2) Fixation of nitrogen. (3) Transformation of insoluble mineral substances into soluble forms.

ROACH (B. M. BRISTOL). **On the Carbon Nutrition of Some Algae Isolated from Soil.** *Ann. Bot.*, Vol. xli, No. clxiii, July, 1927.

An account is given of the growth, both in daylight and in complete darkness, of five species of soil algae, isolated in pure culture, on media containing mineral salts enriched with various sugars. It is shown that all five species are capable of growing in complete darkness, provided that a suitable organic compound is present in the medium, and may therefore be regarded as true soil algae, but that the five species react quite differently to the conditions imposed upon them, and that they vary considerably in the extent to which they are able to grow in the dark. It is concluded that it is not justifiable to regard the soil algae as a homogeneous physiological unit in considering the relation which these organisms bear to the problems of soil fertility.

ROACH (B. M. BRISTOL). **On the Algae of some Normal English Soils.** *Journ. Agric. Sci.*, Vol. xvii, part iv, Oct., 1927.

An account is given of an investigation of the alga-flora of four English soils by means of dilution cultures of freshly gathered samples of soil from the top, second, fourth, sixth and twelfth inch depths and from the top 6 in. mixed. A counting method is described applicable to the green algae and diatoms, by means of which it is shown that these algae are distributed throughout the top 12 in. of soil, though at the sixth and twelfth inch depths they are considerably less numerous than nearer the surface. At the fourth inch depth the numbers of individuals are not significantly smaller than on the surface and may be even greater.

The unmanured plot of Broadbalk wheat field was found to contain the same main species as the adjacent farmyard manure plot but was poor in numbers of individuals. Thirty-five species are described from each plot; they seem to be divisible into two groups, the true soil forms and casual species. Of the true soil forms some grow equally well on the surface and in the lower layers, whereas others are more numerous on the surface than within the soil. The same main types were also obtained from Barnfield and from a cottage garden, but the blue-green species were less conspicuous in both of these soils.

Experimental evidence is given to show that many of the algae of the soil exist in a vegetative condition rather than a resting condition. Biological notes are made on some of the more important or interesting soil species.

ROACH (B. M. BRISTOL). **On the Effect of Light and of Glucose on the growth of a soil Alga.**

Ann. Bot., In Press.

Quantitative physiological experiments under controlled conditions with different intensities of light in presence and in absence of glucose show that

the alga under observation grows by photosynthesis when conditions are favourable for this function to be carried on, even when glucose is present; but that as the intensity of light diminishes the alga absorbs progressively increasing amounts of glucose (if present) to make good the photosynthetic deficiency. The amount of glucose that can be absorbed never exceeds under any conditions that which can be used in complete darkness. The growth rate due to the absorption of glucose never exceeds half that possible by photosynthesis under optimum conditions.

ROACH (W. A.). **Immunity of Potato Varieties from Attack by the Wart Disease Fungus,** *Synchytrium endobioticum* **(Schilb.) Perc.** *Ann. App. Bio.*, Vol. xiv, No. 2. May, 1927.

It is known that grafting together portions of two different plants is sometimes followed by changes in their chemical contents owing to permeation of each by substances formed in the other.

The present investigation is an attempt to determine by grafting together pieces of immune and susceptible plants whether the cause of immunity from wart disease of potatoes is carried by chemical compounds which can traverse unchanged a graft fusion layer or by those which are unable to do so.

For this purpose all the eight possible types of plants have been built up by grafting together root, shoot and tuber systems from either immune or susceptible plants.

In none of the experiments was the reaction of the tubers towards wart disease seen to be changed.

The deduction is therefore drawn that the cause of the immunity is not carried by any compound which is able to traverse the plant.

In this way the problem is considerably narrowed down, for it is now possible to eliminate many lines of attack as unlikely to be fruitful.

The suggestion is put forward that the examination of the proteins from immune and susceptible varieties by immuno-chemical methods is the most helpful future line of attack.

ROACH (W. A.) & GLYNNE (M. D.). **The Toxicity of certain sulphur compounds to** *Synchytrium endobioticum*, **the Fungus causing Wart Disease of Potatoes.** *Ann. App. Bio.*, Vol. xv, Jan., 1928.

The toxicities towards the winter sporangia of *Synchytrium endobioticum* of certain of the simpler compounds which seemed at all likely to be formed from sulphur in soil, were tested.

Sulphuric, sulphurous, dithionic, trithionic, tetrathionic and pentathionic acids were of approximately equal toxicity at the same hydrogen ion concentration while their neutral salts were non toxic. This suggests that the acids owe their toxicity mainly to their hydrogen ions.

Sodium thiosulphate, sodium hydrosulphite and sodium formaldehyde sulphoxylate were of negligible toxicity in neutral solution but in acid solution they showed an even higher degree of toxicity than could be accounted for by their hydrogen ion concentrations. This extra toxicity is ascribed to the small quantity of thiosulphuric acid present in each of the three solutions. Further tests gave support to this tentative conclusion.

SMITH (J. HENDERSON). **Experiments with a Mosaic Disease of Tomato.** *Ann. App. Bio.*, xv, Feb., 1928.

A description is given of a mosaic disease produced in tomato by a virus, possibly identical with Johnson's Tobacco Virus 6, which differs from that of ordinary tomato mosaic in the brilliance and intensity of its leaf-symptoms, but in other respects is indistinguishable from it by the characters investigated.

The filtered juice of infected plants transmits the disease in dilutions in water up to 1 in 10,000, retains its activity for a year or more at room temperature, and withstands heating for ten minutes at 80° C., but is inactivated at 90° C.

It is not inactivated by alcohol up to 90 per cent. The virus comes down with the precipitate, and is not destroyed when the formation of precipitate is prevented by the addition of NaOH.

Attempts at cultivation of the virus outside the living plant are described; all were unsuccessful. The methods employed in filtration, inoculation, etc., are given in detail.

UNIVERSITY COLLEGE OF WALES, ABERYSTWYTH.

DAVIES (D. W.) & JONES (E. T.). **Further Studies on the Inheritance of Resistance to Crown Rust** (*P. Coronata* **Corda**) **in F_3 Segregates of a Cross between Red Rustproof** (*A. Sterilis*) **and Scotch Potato** (*A. Sativa*). *Welsh Journ. Agric.*, Vol. iii, p. 232. Jan., 1927.

This paper is a verification of the conclusions arrived at, and reported upon, in the previous volume of this Journal.

Of the F_2 segregates grown to maturity, 35 plants were selected at random to provide seed for testing in the next or F_3 generation. Twenty-nine of these plants had been classified in the F_2 generation as resistant and the remainder as susceptible. Altogether 83 seedlings comprising the six different susceptible families were inoculated and exhibited complete susceptibility. The remainder or the resistant plants in the F_3 generation segregated in the ratio of 1 : 1·9, and in this respect showed close agreement with a 1 : 2 ratio such as would be expected upon a monohybrid interpretation of results. Although the total number tested is small, it is very unlikely that any deviation from a unifactorial interpretation of the data would result. The behaviour of the F_2 plants, confirmed by the reactions of F_3 seedlings in this particular cross, supports the conclusion that susceptibility to crown rust behaves in inheritance as a simple recessive.

SAMPSON (K.). **The Relative Resistance of Wheat Varieties to Bunt** (*Tilletia tritici*). *Welsh Journ. Agric.*, Vol. iii, pp. 180–196. Jan., 1927.

Forty pure line selections of Hen Gymro wheat were tested for bunt resistance. All the selections gave high percentages of infection and no correlation was observed between morphological characters and the reaction of the different selections to the parasite.

Relatively high susceptibility to bunt (56 per cent. to 91 per cent.) was shown also by 32 varieties of British wheats tested in one experiment. Two varieties, Martin and Hussar, which have proved to be immune to *Tilletia tritici* in America, gave negative results in the Welsh trials. Relatively high resistance to bunt was shown also by the American varieties White Odessa, Ridit and Turkey. The variety Heils Dickkopf, which is stated to be relatively resistant in Germany, was distinctly less susceptible than the British varieties tested.

In the majority of varieties tested, bunted plants showed complete invasion of the ear, but in three varieties, Florence, Heils Dickkopf and Pommersche, 33 per cent. to 45 per cent. of healthy grain occurred among the diseased kernels of infected spikes.

SAMPSON (K.) & DAVIES (D. W.). **The Influence of** *Tilletia tritici* (**Bjerk**) **Wint. and** *Tilletia laevis* (**Kühn**) **on the Growth of Certain Wheat Varieties.** *Ann. App. Bio.*, Vol. xiv, No. 1, pp. 83–104, 2 pl., 1 graph. Feb., 1927.

This paper gives the results of field and greenhouse experiments dealing with the effect of bunt on the growth and vegetative organs of the wheat plant.

No appreciable difference was found in the percentage germination in soil of bunt-free and bunt-contaminated seed, but under certain conditions a marked difference in favour of bunt-free samples was shown by the final figures for establishment.

Measurements taken during the entire period of growth showed that plants infected by *T. tritici* were distinctly retarded in growth in height. Thus in the case of Hen Gymro a reduction in the height of straw at maturity amounting to 16 to 19 per cent. was observed. In this variety a reduction was also recorded in the length of the ripe ear.

In one experiment, where data were obtained on the dry weight of roots at maturity, bunted plants showed a decrease of 23 per cent.

Tillering, on the other hand, was apparently stimulated by the parasite. At the period of the maximum development of tillers, bunted plants showed 16 per cent. more than those which were bunt-free.

The influence of *T. laevis*, while tending in the same direction as that of *T. tritici*, was found to be distinctly weaker.

UNIVERSITY COLLEGE OF NORTH WALES, BANGOR.

WHITEHEAD (T.). **Experiments on the Control of Potato Leaf-Roll.** *Welsh Journ. Agric.*, Vol. iii. 1927.

The fact that the cropping power of potatoes in England and Wales is reduced when home-saved seed is used more than once or twice is well-known, and is now generally ascribed to the effects of virus disease infection. On the other hand, the usual remedy of securing new seed from Scotland has certain disadvantages, apart from the occurrence of virus diseases in some seed-potato producing areas of Scotland. The writer has been engaged since 1923 in exploring various means of controlling the spread of virus diseases in potato crops in N. Wales, in the hope that this would enable home-saved seed to retain its productivity over a number of years. The work directs attention mainly to potato leaf-roll, and the results are summarised under three heads, i.e. (1) The removal or 'rogueing' of diseased plants from the crop; (2) The selection of tubers from healthy plants at lifting time on the basis either of the size of tuber or of the vigour of the 'parent' plant; (3) The lifting of the crop from healthy plants as early as possible in the growing season.

The conclusions reached are (1) That rogueing out diseased plants is only likely to be of value in slightly infected stocks and in areas in which transmission of leaf-roll takes place only slowly; (2) No improvement in the health of the stocks was effected, either by selecting large tubers or those from the most vigorous plants, for seed purposes; (3) On the other hand very considerable improvement was effected by lifting tubers for seed, from healthy plants, not later than the middle of August; the latest date at which this can safely be done varying each year owing to the seasonal variation in infection with virus diseases and infestation with insect vectors.

UNIVERSITY OF BRISTOL AND LONG ASHTON FRUIT RESEARCH STATION.

BALL (E). **Some observations on "Red Plant" of Strawberries.** *Ann. Rep. Agric. & Hort. Res. Stn., Long Ashton.* 1926.

The symptoms by which "red plant" of strawberries can be recognised in the spring and also in late summer are described. Recognition is more easy at the young period than at any other time of the year and it is at this time that affected plants should be destroyed. Some "strains" were found to be more badly affected than others and in six "strains" under observation at Long Ashton the intensity with which the disease occurred in the several strains for each of three generations was remarkably consistent. This, with

other facts, indicates that the disease can probably be controlled by "rogueing," *i.e.*, systematic elimination of diseased plants. The disease was found to occur in several strawberry growing districts and several important commercial varieties were seen to be affected.

NATTRASS (R. M.). **Report of Advisory Work in Economic Mycology.** *Long Ashton Ann. Report*, pp. 134–144. 1926.

The outstanding features of the weather in 1926 were a cold spring, prolonged until the end of June, followed by a spell of hot weather concluding with a warm damp period.

Apple.—Splitting of the skin occurred generally, followed by rots due chiefly to *Monilia fructigena*, but sometimes caused by *Nectria galligena*. Bordeaux mixture (8–25–100) on Worcester Pearmains gave excellent control of scab but caused extensive cracking. The peculiar weather conditions are thought to be chiefly responsible. Mildew was exceptionally prevalent. A die back of twigs is recorded brought about by *Monilia cinerea* and a form of canker due to *Fuckelia conspicua*.

Pear.—Rots caused by *Nectria galligena* and *Phytophthora sp.* are recorded.

Plum.—Skin splitting followed by brown rot (*Monilia fructigena*) was extremely prevalent. Spraying in June with 6 per cent. Mortegg for control of *Monilia cinerea* gave promising results. An early and very severe attack of plum rust (*Puccinia pruni-spinosæ*) occurred in some instances causing complete defoliation.

Gooseberry.—American gooseberry mildew was serious especially on "Whinham's Industry."

Raspberry.—Mosaic and anthracnose (*Gloeosporium venetum*) were widespread. Attempts to produce crown rot by inoculations with *Nectria rubi* were unsuccessful.

Willow.—A leaf spot and canker due to a *Physalospora sp.* having a *Gloeosporium* conidial stage was observed and studied. The fungus was isolated and proved to be a virulent parasite ; both ascospores and conidia were able to infect unwounded leaves and growing points, thence growing down into the rods and causing cankers. Anthracnose (*Marssonia sp.*) was also noted.

Asparagus.—Investigations are in progress on the soil-dwelling fungal parasites causing 'soil sickness' of asparagus land.

Potato.—Tuber and root rots due to *Rosellinia necatrix* and *Rhizoctonia solani* are recorded. Results are given of a trial of Swiss varieties for immunity to late blight.

NATTRASS (R. M.). **Further Experiments on the Control of American Gooseberry Mildew.** *Journ. Min. Agric.*, Vol. xxxiii, No. 11, pp. 1017–1022. 1927.

In continuation of his work on the control of American gooseberry mildew (*Sphaerotheca mors-uvae*), the author records in this paper the results of further experiments which were carried out in the Bristol area during 1926.

In the first series one application of Burgundy mixture (8–20–100) was tested against one or two applications of ammonium poly-sulphide and soft soap (½ gallon and 5 lb., respectively, in 100 gallons of water). Seven plots of the Whinham's Industry variety were used for the experiment; the first applications were given immediately after the flowers had set, on April 22nd, and the second spraying, where applied, on May 18th. The Burgundy mixture plots gave 482 lb. clean fruit and 4·3 per cent. mildewed, against 143½ lb. clean and 39·9 per cent. mildewed from the control plot, whilst the plots sprayed once and twice with ammonium poly-sulphide soap gave 456 lb.

and 502 lb. clean and 15·5 per cent. and 5·6 per cent. mildewed fruit, respectively. No damage occurred except on the plots sprayed with Burgundy mixture where after about ten days a certain amount of spotting was observed.

In the second series of experiments, Whinham's Industry bushes were again used, and the spraying done on the same dates as above, two applications being given in each case. Of the sprays tested ammonium poly-sulphide and soft soap (½ gallon to 6 lb. in 100 gallons of water) gave 169 lb. clean fruit and 16·3 per cent. mildewed; proprietary soda sulphur compound and soft soap (10 pints—6 lb. in 100 gallons) gave 122 lb. clean and 14 per cent. mildewed; washing soda and soap (18 lb—10 lb. in 100 gallons) gave 95 lb. clean and 30·1 per cent. mildewed, against 66 lb. clean and 53·7 per cent. mildewed. from the control plot. Heavy showers of rain after the second spraying much impaired its value, but the poor control obtained was thought to be largely due to the situation of the plot, which was partly overshadowed by tall elms, being especially favourable to the disease. The author considers that the soda and soap acts mainly as a direct killing spray and must be applied as often as weather conditions render it necessary.

NATTRASS (R. M.). **Onion Immunity Trials, 1926.** *Long Ashton Ann. Report*, p. 65. 1926.

Varieties of onion were planted near Bristol in land infected with *Sclerotium cepivorum*, the cause of white rot. The season was exceptionally favourable for the development of the disease and the percentage of affected bulbs found in each variety was as follows:—Magnum Bonum 25 per cent., Giant Zittal 21 per cent., Cranston's Excelsior 20 per cent., A.1. 18 per cent., White Lisbon 17 per cent., Bedfordshire Champion 16 per cent., Wroxham Globe 10 per cent., Ronsham Park Hero 8 per cent., Up-to-date 5 per cent.

NATTRASS (R. M.). **The White Root Rot of Fruit Trees caused by** *Rosellinia Necatrix*. (Progress Report). *Long Ashton Ann. Report*, pp. 66–72, pls. 2. 1926.

The author describes the finding of *Rosellinia necatrix* on roots of apple at Taunton and Winscombe (Somerset) and gives records of its occurrence in England on potato, narcissus, elm and arum. On the apple a white flocculent mycelium invests and gradually destroys the young roots, while the adjacent soil becomes permeated with hyphæ. A mature apple tree thus attacked dies in two to three years.

The fungus was obtained in pure culture and grown in sterile sand. This sand culture placed in contact with three-year-old apple seedlings infected and killed them within two months. Successful infections were also obtained on French beans.

Under natural conditions, no fructifications of the fungus were obtained; sclerotia occur and it is highly probable that these form the resting stage of the fungus in England.

Young trees in an early stage of attack can be saved by removing diseased material and replanting; other infected trees should be burnt. For destroying mycelium in the soil bare fallowing with frequent cultivation is suggested.

NATTRASS (R. M.). **Notes on** *Nectria Rubi*. **II.** *Trans. Brit. Mycol. Soc.*, xii, pp. 23–27. 1927.

In raspberries showing crown rot the internal tissue of the crown and base of the canes is discoloured and occupied by hyphæ; wilting and death of the canes results. Specimens of Baumforth's Seedling from Worcestershire showing these symptons bore perithecia of *Nectria rubi* in the region of the crown; the perithicial and *Fusarium* stages of this fungus are described and the cultural characters given. The disease has only been found under conditions which suggest waterlogging and it is not thought that *Nectria rubi* is an active parasite.

UNIVERSITY OF OXFORD.

WOODWARD (R. C.). **Studies on** *Podosphaera leucotricha* **(Ell. & Ev.) Salm. I. The Mode of Perennation. II. Observations upon some host-parasite relationships.** *Trans. Brit. Mycol. Soc.*, Vol. xii, 173–204, 11 figs., 4 pl., 30th June, 1927.

This paper is the result of research during the years 1923–27 at the Botany School, Cambridge, and latterly at the School of Rural Economy, Oxford. It was found that *P. leucotricha* perennates by means of hyphae, attached to haustoria, in dormant apple buds. The young buds are invaded by mildew mycelium soon after their formation. The following subjects are dealt with: the germination requirements of conidia, the function and condition of perithecia, cuticular penetration, the endophytic habit of the mycelium, the means of resistance adopted by the plant, the biological strain on apple, pear and quince, susceptibility of varieties, preliminary trials to control the disease.

UNIVERSITY OF CAMBRIDGE.

DILLON-WESTON (W. A. R.). **A Note on the "Bud-Rot" of apple Trees.** *Trans. Mycol. Soc.* June, 1927.

A "Bud-Rot" of apple trees is described and it is assumed that this is caused by *Fusarium fructigenum* (Fr.). The disease previously was referred to as *Fusarium sp.*

DILLON-WESTON (W. A. R.). **The Incidence and Intensity of** *Puccinia glumarum* **Eriks. and Henn, on Wheat Infected and Non-infected with** *Tilletia tritici* **Winter, Showing an Apparent Relationship between the Susceptibility of Wheat plants to Yellow Rust and to Bunt.** *Ann. App. Bio.*, Feb., 1927.

In the season 1925–26 an interesting relationship was noticed between yellow rust of wheat, *Puccinia glumarum*, and bunt stinking smut of wheat, *Tilletia tritici*; it was observed that:—

Bunted Little Joss wheat plants were badly rusted and that plants free from bunt were free or comparatively free from rust.

Bunted plants of other wheat varieties were definitely more rusted than plants free from bunt.

It is suggested that rust resistance which cannot be broken down artificially may be broken down by natural contamination of wheat with the bunt fungus.

DILLON-WESTON (W. A. R.). **Notes on the Canker Fungus** (*Nectria galligena* Bres). *Trans. Mycol. Soc.* Mar., 1927.

One method of over-wintering of the apple "canker" fungus (*Nectria galligena* Bres) is by the formation of perithecia upon shrivelled fruits.

The Fusarium stage of canker (*Fusarium Willkommi* Lindan) is responsible for an "Eye Rot" of Worcester Pearmain.

Evidence is brought forward to show that one case of wilting of Worcester Pearmain blossom trusses was due to the canker fungus, but no explanation is advanced as to the mode of infection.

An unusual form of Pear Canker is described.

UNIVERSITY OF LEEDS.

MILLARD (W. A.) & BURR (S.). **A Study of Twenty-four strains of Actinomyces and their Relation to Types of Common Scab of Potato.** *Ann. App. Bio.*, xiii, 4, pp. 580–644, 6 pl., 2 figs. 1926.

The authors, being of opinion that various isolations of the potato scab organism could not be included in the single species *Actinomyces scabies*,

have made a detailed investigation of these strains in pure culture and of the different types of scab which they produced on inoculation into potato tubers.

Twenty-four strains of *Actinomyces* were isolated from potato scabs and other sources, and a technique was evolved for maintaining their cultural characters constant in sub-culture. Each strain was fully tested for pathogenicity by methods which are described in detail. The results of these experiments showed one species identical with the original scab organism, *A. scabies*, both in its cultural characters and in the nature of the lesion it produced, while the remainder, allowing for some duplicate strains, are regarded as belonging to 19 new species, which are named, with full particulars of their morphological, cultural, and biological characters. Eleven of the species produced scab on potatoes.

Descriptions are given of the different types of scab found or produced during the course of these investigations. The differences are believed to be due chiefly to the different species of Actinomyces concerned, though the variety of potato may slightly modify the type of disease. *A. scabies* produces a deeply furrowed scab ("deep scab") and may also be found attacking the roots and stolons of the plants.

There is also a discussion on the occurrence of scab in virgin soils, and the predominance of certain types of scab in certain soils and in different years.

MILLARD (W. A.) & BURGESS (—). **Blindness in Barley.** *Univ. of Leeds and Yorks Council for Agric. Educ.*, No. 151. 1927.

The authors show that the complaint known as Blindness is of two kinds. The first which is called "Stripe Blindness" is due to the attack of the fungus *Helminthosporium gramineum* and may be distinguished by the dark colour of the affected ear; the grain although often badly shrivelled is generally present. The second has previously been known as Physiological Blindness or Schartigkeit (gapping) and is not connected with any fungoid or bacteria attack. In it there is no discoloration of the ear, but the grain of the affected spikelets is generally absent. Other spikelets on the same ear may be perfectly normal. This form, which the authors call True Blindness, and to which their investigation is confined, is said to account for 80 to 90 per cent. of the complaint. From the experiments carried out it was found that those spikelets, which would ultimately be blind, could be recognised a week or ten days after the emergence of the ear from the sheath by their transparent appearance. Such spikelets were invariably invaded by Thrips in the adult and larval stages and these insects apparently fed on the ovary which finally withered away. Apart from the presence of these insects the affected spikelets appeared to be normal as regards the essential organs; in nearly all cases the stigmas were well dusted with pollen and pollen tubes growing down through the stigma were demonstrated. It was noted that the flowering glumes of these spikelets always gaped apart and thus allowed the Thrips to enter them more readily than the normal spikelet. The authors point out that Johannsen regards this form of Blindness as hereditary, and they suggest that, if this is the case, the hereditary character is that of the gaping of the glumes. In this way the Thrips attack may be regarded as the *modus operandi* through which expression in the form of Blindness is given to this simple character. This would account for the fact that the Blindness is certainly more prevalent in some years than in others.

Certain varieties were found to be much more susceptible than others to the complaint; Standwell and Plumage were very susceptible, whilst Spratt Archer, Plumage Archer, Archer Goldthorpe, Binder, Primus and Gold were highly resistant. In 1926, early sown crops showed less Blindness than later sown crops and this result affords confirmatory evidence to the authors' conclusions.

Millard (W. A.) & Taylor (C. B.) **Antagonism of Micro-organisms as the controlling factor in the inhibition of Scab by green-manuring.** *Ann. App. Bio.*, Vol. xiv, No. 2, May, 1927.

The authors have carried out series of soil inoculations in pots with a parasitic and a saprophytic species of Actinomyces. In their most critical experiment an equal amount of inoculum of the parasite was added to each pot whilst increasing amounts of the saprophyte were given in the series. In one series soil alone was used, and in another grass cuttings were introduced into all pots. Sterilised potato sets were then planted in all pots. It was found in both series that the greater the inoculum of the saprophytic Actinomyces in the pots, the less the scab produced. This result assumed greater significance when it was also noted that in the pots receiving no inoculum of the saprophyte grass cuttings failed to bring about any scab reduction.

Soil counts were made at intervals from the pots, and these showed that the saprophytic species had exerted a strongly depressing action on the parasitic species. The authors suggest therefore that when green manure is added to the soil the rapid multiplication of the saprophytic species of Actinomyces and Bacteria depresses the growth of the Scab producing Actinomyces to a point at which their parasitic attack on the potato is negligible.

Millard (W. A.) & Beeley (F.). **Mangel Scab—Its Cause and Histogeny.** *Ann. App. Bio.*, Vol. xiv, No. 3, Aug., 1927.

Three types of scab are distinguished corresponding roughly to similar types on the potato. Of these the mound and knob scabs, which form large protuberances on the surface of the mangel, are the more common and the more conspicuous, but the pitted type causes the greater tissue destruction. From Mound Scab five strains of Actinomyces were isolated but one only proved to be pathogenic. The cultural characters of this organism were found to be very distinctive and hitherto unrecorded; the species was therefore named *Actinomyces tumuli*. The organism of pitted scab proved to be *Actinomyces scabies* (Thaxter) Güssow emend M and B, which is a virulent scab producer on potatoes. This organism was also found to attack the roots of mangels which are thereby covered with dark brown nodular outgrowths.

The origin of the tissue composing the Mound and Knob scabs was investigated. This was found to arise mainly from a meristematic proliferation of the pericyclic zone below the seat of infection. By this means a mound of tissue is raised carrying the parasite in its outer layers. A cork cambium eventually arises towards the periphery of the mound producing a layer of cork which entirely cuts off further invasion by the parasite. The destruction of tissue by the latter is extremely slight. If the pericycycle ceases to proliferate after this cork layer has been formed a mound-like scab results. If, on the other hand, the pericycle continues to increase, lateral overhanging bulges of tissue are formed, and a knob-like scab is produced.

In pitted scab no proliferation of the pericycle occurs after infection but a deep seated and strongly suberised corky layer is produced. This is often insufficient to prevent the passage of the organism and the destruction of tissue is considerable.

MIDLAND AGRICULTURAL AND DAIRY COLLEGE.

Stirrup (H. H.). **Black Scurf in Potatoes.** *Agric. Prog.*, Vol. iv.

This paper describes the observations and results of experiments for three years on this disease in England.

The symptoms on the tubers and on the potato plant itself (including the collar fungus or Corticium stage) are described.

No rot of any kind is caused to the potato tuber by the presence of this fungus. There is no doubt, however, that *under certain conditions* the fungus is responsible for "misses" in the potato field.

The results of experiments carried out in 1922, 1923, and 1924 are given, and it was concluded that they showed that, while a certain amount of damage is done by this disease, it is insufficient to warrant the treatment of "seed" tubers with either formalin or mercuric chloride.

STIRRUP (H. H.). **Some Potato Diseases.** *Derbyshire Young Farmer*, Vol. vi, No. 5.

This article includes a few notes on some of the common potato diseases such as "Blight," "Blackleg," "Virus diseases" which were prevalent at the time the article appeared. Suggestions for the control or prevention of these troubles are also given.

STIRRUP (H. H.) & ROEBUCK (A.). **Parsnip Canker.** *Journ. Min. Agric.*, Vol. xxxiii, No. 9, Dec., 1926.

A general account of the disease is given including the influence of soils, manures and climate. The various aspects of the problem of control are discussed. Sudden checks during the growing season are considered to be responsible for the disease. An account is given of a test of varieties and as a result a provisional grouping is made into (*a*) Slightly attacked, e.g., "Tender and True"; (*b*) Moderately attacked, e.g., "Student," and (*c*) Severely attacked, e.g., "Evesham."

STIRRUP (H. H.). **Report on Celery Blight and its Prevention.** *Midland Agric. Coll., Bull., No. 14.*

This paper is the result of investigations and experiments in North Lincolnshire for the last three years on "The leaf spot" or "Blight" (*septoria apii*) disease of celery.

A full description of the symptoms of this disease is followed by a discussion on the weather conditions favourable to it. The question of infected seed, from which the disease begins, and methods of treatment of such seed are dealt with. In addition to clean cultivation, spraying with Bordeaux or Burgundy mixture is recommended as a valuable preventive measure against celery blight. In 1926 the average weight of 100 bundles of celery sprayed with these preparations was 18 cwts. 2 qrs., compared with only 9 cwts. 2 qrs. for the unsprayed. The total cost of spraying one acre (producing 1,500 bundles) eight times was £3 and the estimated net profit (calculating 1s. 0½d., per bundle for treated and 5d. for untreated celery) was £45 8s. 9d.

UNIVERSITY OF READING.

BUDDIN (W.) & WAKEFIELD (M.) **On the Life History of a Fungus parasitic on *Antirrhinum majus* with some remarks on the Genus *Heterosphæria*.** *Trans. Brit. Mycol. Soc.*, xi, 3–4, pp. 169–186, 8 figs. 1926.

In this paper the authors give an account of their further investigations of the shot-hole disease of antirrhinums caused by *Cercosporella antirrhini*, which has become one of the most common and destructive diseases of antirrhinums in Great Britain.

Under certain conditions numerous pale pinkish acervuli are found on the leaf spots, and masses of sickle-shaped septate conidia of the *Cercosporella* type are borne on branched conidiophores. In pure cultures numerous blackish apothecium-like bodies were formed which remained quite sterile, until transferred to fresh tubes, when they produced conidia. Similar bodies were found on dead overwintered antirrhinum stems which had shown the disease during the previous summer. These bodies were found to be pycnidial fructifications belonging to the genus *Heteropatella*. Proof of the connexion of this stage with the *Cercosporella* was obtained by inoculating living

antirrhinums with *Heteropatella* conidia, and obtaining the characteristic spots and shot-holes of the *Cercosporella* on the leaves. Repeated attempts to obtain the ascigerous stage of the fungus have been unsuccessful; but by analogy with other species of *Heteropatella* the writers suspect that such a stage, should it appear, will prove to belong to the genus *Heterosphæria*. The relationship of antirrhinum fungus with *Heteropatella* is further confirmed by its temperature relations which agree with those found by Vestergren for *Heteropatella Gercosperma* (Rostr.) Lind.

The writers suggest that the *Cercosporella* stage in the life-history of a *Heterosphæria* may be a new development correlated with the adoption of the parasitic habit ; and further that the species on antirrhinum may have arisen as a saltation from *Heteropshæria linariæ* which occurs on dead stems of the related species *Linaria vulgaris*.

In a supplementary note (pp. 186–188) the authors, having obtained fresh material of the *Linaria* fungus, were able to compare it with their species on antirrhinum. From cultures and inoculation experiments it was shown that the two are slightly different morphologically, and very different physiologically. They therefore describe the pycnidial form of *C. antirrhini* found by them on *Antirrhinum majus* as a new species to which the name *Heteropatella antirrhini* is given, a Latin diagnosis being appended.

Buddin (W.). **Experiments in the control of bunt (*Tilletia tritici*) in wheat, carried out at the University Farm in 1924, 1925 and 1926.** *Univ. of Reading, Guide to Univ. Farm and Exper. Sta.*, 1927, pp. 42–44, 1927.

The most consistently successful results in the control of wheat bunt (*Tilletia tritici*) in the Martin variety during the period 1924 to 1926 were given by the liquid copper sulphate treatment (3 lb. per 4 galls water, applied at the rate of 1 gall. to 4 bushels), which reduced the incidence of infection from 41, 72 and 29·7 per cent. to 1·4, 6·1 and 0·35 per cent. respectively. For the badly contaminated seed-grain employed in these tests it was necessary to use formaldehyde at a strength of 1 in 320 to obtain complete control, but for average samples the 1 in 480 concentration (1 gall. to 2 bushels) is adequate. Copper carbonate dust (3 oz. per bushel) is stated to be effective against bunt in cases of moderate infection, but it has been found inferior to copper sulphate against severe contamination. Liquid germisan (0·5 per cent.), tutan dust, and porzol dust (3 oz. per bushel) appear to be the most promising of the organic mercury compounds which are largely used on the Continent, but these preparations have been found in no way superior to copper carbonate or the wet treatments, and their toxicity is a decided drawback. A table is given showing the results of the various treatments.

Buddin (W.) & Wakefield (E. M.). **Studies on *Rhizoctonia crocorum* (Pers.) DC. and *Helicobasidium purpureum* (Tul.) Pat.** *Trans. Brit. Mycol. Soc.*, xii, 2–3, pp. 116–140, 4 pl., 1927.

The opinion expressed by the authors in their former paper (R.A.M., iv, p. 247) that *Helicobasidium purpureum* is the perfect stage of *Rhizoctonia crocorum* was substantiated by the discovery in three widely separated localities of a fertile form of the former in very close association with a root rot characterized by "infection cushions" of the latter on red clover (*Trifolium pratense*), *Mercurialis perennis*, and *Urtica dioica*. Morphologically, both fungi are exactly similar, their hyphae exhibiting the same type of branching, septation, and absence of clamp connexions. They also resemble one another in nuclear characters in that their cells are sometimes uni- but more often binucleate. Seven strains of *R. crocorum* obtained from various sources were compared with numerous spore isolations of *H. purpureum* as to cultural characters, considerable variations in colour and type of growth being noted

in both fungi. Conidia of a *Tuberculina* type were frequently produced in cultures of *H. purpureum* and occasionally in cultures of strains of *R. crocorum* isolated from nettles and mangolds. Subcultures of *H. purpureum* sometimes developed strains which acquired the dark colour characteristic of the sterile strains of *R. crocorum*, and which afterwards remained sterile; a similar variation was noticed in the strain of *R. crocorum* from nettles, which at first only produced a pale growth with a tendency to form conidia.

Inoculation experiments on various legumes and carrots gave positive results, with the production of typical root rot, with four of the seven strains of *R. crocorum*, and with three dark-coloured strains of *H. purpureum* originating from specimens associated with red clover. Although no specialization in parasitism was noted in other strains of *R. crocorum*, none of those from *Urtica* produced any infection on clovers or carrots, the same also applying to *H. purpureum*.

In a discussion of the results obtained, the authors point out that the balance of the evidence is in favour of the genetic relationship between the two fungi. The inconsistencies noted in the behaviour of the cultures may be due to the fact that the organism is very variable, and that not all the strains are equally parasitic. It must also be remembered that very little is yet known as to the conditions for infection with *R. crocorum*.

SEALE-HAYNE AGRICULTURAL COLLEGE, NEWTON ABBOT.

Beaumont (A.) & Hodson (W. E. H.). **Third Ann. Report of the Dept. of Plant Path.** *Seale-Hayne Agric. Coll.* Pamph. 21, 25 pp. 1927.

This pamphlet contains an account of the occurrence of fungal diseases of crops in Devon and Cornwall during 1926, a list of diseases not recorded in the previous reports, and a number of articles on diseases of special interest.

An attack of Damping off (*Pythium* de Baryanum) on oats is recorded for the first time in England. The affected part of the field was considerably retarded and, although many plants recovered, the stand was considerably reduced. Heart Rot of Mangolds (*Phoma betae*) was unusually severe. It was not specially associated with alkaline soils, though none of the soils on which it occurred was acid; the principal causative factor was probably the dry summer. No relation was observed to the attacks of Black-leg.

Botrytis cinerea attacks a wide range of wild and cultivated plants in suitable weather, and its occurrence on strawberry, gooseberry, cabbage, potato, &c., is described. A short account is given of the Hard Rot of Gladioli (*Septoria Gladioli*), and a study of the relations of the leaf-spot to the rotting of the corms is begun. Tulip Fire (*Botrytis tuliape*) is the most destructive disease of the tulip. The leaves and flowers are attacked by aerial spores and sclerotia may be formed on the bulbs. Very often, however, the bulbs are not affected; they should be lifted as early as possible and planted in fresh soil; infected bulbs should be rejected at the same time. Weather conditions greatly influence the spread of the disease.

A rare disease of wheat (*Dilophospora alopecuri*) is recorded for the first time in Devon.

SOUTH EASTERN AGRICULTURAL COLLEGE, WYE.

Goodwin (W.) & Martin (H.). **The Lime Sulphur—Calcium Arsenate Spray.** *Journ. Agric. Sci.*, Vol. xvi, p. 596. 1926.

This investigation is an extension of a previous communication on the lime sulphur-lead arsenate spray (*Journ. Agric. Sci.*, vol. xv, p. 307, 1925.) The results obtained show :—

(*a*) That the addition of lime to dicalcium arsenate reduces the amount of arsenic in solution. This reduction is temporary and on exposure to atmo-

spheric carbon dioxide the original solubility of the dicalcium arsenate is restored. The concentration of soluble arsenic in the dicalcium arsenate-lime spray will not be as great as in the dicalcium arsenate spray, and the risk of spray injury with the dicalcium arsenate spray is therefore reduced when lime is added.

(*b*) The concentration of soluble arsenic in the dicalcium arsenate and lime spray is reduced by the admixture of lime sulphur with a corresponding reduction of the risk of foliage injury.

(*c*) The precipitation of sulphur from the calcium polysulphides of the lime sulphur is unaffected by the addition of dicalcium arsenate. The addition of lime may result in a diminution of the amount of sulphur so precipitated, but such a reaction is dependent on the rate of carbonation of the free lime on the leaf surface. The fungicidal activity due to the calcium polysulphides is therefore unaffected by the addition of dicalcium arsenate but may be adversely influenced if excess calcium hydroxide be present.

Goodwin (W.) & Salmon (E. S.). **Notes on two fungicides: Sulphur and Bordeaux Mixture.** *Journ. Min. Agric.* Vol. xxxiv, No. 6, Sept., 1927.

A method is described of making a fluid wash of "wetted" sulphur with and without soft soap. The fungicidal action of the sulphur in this wash was observed to be far more rapid and complete than when sulphur was applied in powder form.

As a dust against powdery mildew of the hop, finely ground sulphur was found to be equal in fungicidal power to sublimed sulphur.

A method is described of making Bordeaux mixture with hydrate of lime in the place of quicklime. Preliminary experiments showed that apple scab was controlled to an equal extent by Bordeaux mixtures made with hydrate of lime and quick lime respectively without any scorching injury.

Harrison (R. M.) & Ware (W. M.). **Downy Mildew of the Vine again in England.** *Gard. Chron.*, lxxx, 448–9 with 3 figs. 1926.

This is the only record of the disease in England since its first appearance here in 1894. A description is given and the history of its world-wide spread is detailed.

Salmon (E. S.). & Ware (W. M.). **Leaf Rot of the Carnation.** *Gard. Chron.*, lxxxi, 196–216, with 4 figs. 1927.

This disease, caused by the fungus *Pseudodiscosia dianthi*, is recorded for the first time in England. An account of the occurrence is given and parts of the original description are abstracted from the first German record of 1921.

Salmon (E. S.) & Ware (W. M.). **The Downy Mildew of the Hop in 1926.** *Journ. Min. Agric.*, Vol. xxxiii, No. 12, with 5 figs. March, 1927.

An account is given of the continued spread of the disease abroad, and of the serious damage it has caused to the hop crop on the Continent.

In 1926 outbreaks of the downy mildew occurred on the hop cones in a number of gardens in Kent and adjoining counties, in a few cases ruining their colour to such an extent that the hops were not picked.

As regards attacks on the cones, the variety Tolhurst proved, under the conditions of 1926, to be very susceptible and Fuggles more resistant.

Cases are recorded where the "spiked" growths, caused by the fungus, were systematically removed from the hop garden and the spread of the disease to the cones prevented.

Confirmation has been obtained (*a*) that the lateral shoots produced below the "spiked" tips of bines, five to seven feet high, are usually healthy and may, therefore, safely be trained up; and (*b*) that the spawn (mycelium) of the fungus may be present in the rootstock of the hill.

The flowers of the male hop may be seriously attacked.

SALMON (E. S.). **On Forms of the Hop Resistant to Mildew. VI. Temporary Loss of Immunity.** *Ann. App. Bio.*, xiv, 263, Aug., 1927.

Three seedling varieties of hops which had previously shown complete resistance to "powdery mildew" (*Sphaerotheca Humuli*) became slightly infected in the greenhouse in the early spring. The susceptibility shown was only temporary; all the infected plants again acquired during May and June their power of complete resistance. The conidia produced on an "immune" plant proved unable to infect that plant, although able to infect a susceptible variety. It appears probable that abnormal weather conditions (possibly low temperature) brought about the temporary susceptibility.

SALMON (E. S.) & WARE (W. M.) **Root Rot of** *Richardia*. *Gard. Chron.*, lxxxi, 234, April, 1927.

A description is given, with illustrations, of a disease of *Richardia* (*Richardia*=*Calla* and *Arum*) occurring in Berkshire and at Folkestone, Kent. The fungus was found to be a species of *Phytophthora*, and agreed in its characters with *P. Richardiae*, recently described as the cause of a root-rot of *Richardia* in Holland. The best methods of control of the disease are discussed.

SALMON (E. S.) & WARE (W. M.). **Leaf Scorch of Azalea.** *Gar . Chron.*, lxxxi, 286, 1927.

A description is given, with illustrations, of a leaf-disease of Azalea, occurring in a nursery at Hythe, on plants imported from Belgium in 1926. The fungus is identified as *Septoria azaleae*, reported as attacking the Azalea in Germany and Italy. The best methods of control are discussed.

SALMON (E. S.) & WARE (W. M.). **The Powdery Mildew of Flax.** *Gard. Chron.*, lxxxii, 34, July, 1927.

A description is given, with illustration, of a disease of seedling plants of Flax which occurred at Cambridge. The fungus proved to be the conidial (*Oidium*) stage of a species of the *Erysiphaceae*, and is probably identical with *Oidium Lini* Skoric. The occurrence of a powdery mildew on Flax reported by various observers in different countries is noted and discussed.

SALMON (E. S.) & WARE (W. M.). **Grafting Experiments with Varieties of Hops resistant to the Hop Powdery Mildew.** *Ann. App. Bio.*, xiv, 276, Aug., 1927.

Twenty composite plants were built up by grafting either a scion of an immune variety of hop on a susceptible stock, or *vice versa*. Inoculation of young leaves of the scion showed that no change had been effected in the varietal immunity or susceptibility in relation to *Sphaerotheca Humuli*. In these experiments, scions of six different immune varieties were grafted on stocks of four different susceptible varieties and scions of four different susceptible varieties were grafted on stocks of five different immune varieties. The results obtained render it improbable that immunity or susceptibility to *S. Humuli* is connected with any translocatable substance in the hop-plant.

MINISTRY OF AGRICULTURE AND FISHERIES. PATHOLOGICAL LABORATORY.

PETHYBRIDGE (G. H.). **Fungus and Allied Diseases—ex Plant Pests and Diseases in 1926.** *N.F.U. Year Book*, 1927, pp. 162–165.

Notes are given on the prevalence and control of various diseases of economic crops in England during 1926.

In connection with a brief statement on black rust of wheat (*Puccinia graminis*) it is mentioned that common barberry (*Berberis vulgaris*) bushes are increasingly in demand for planting purposes, and the risk of spreading infection by this means is briefly explained.

Extended treatment of wheat seed-grain with copper sulphate or formalin for the control of bunt (*Tilletia tritici*) is urged. Dusting with copper carbonate has been found (in preliminary trials) to be reasonably effective in the case of mild infection, but it cannot replace the liquid disinfectants for severe contamination.

Potato blight (*Phytophthora infestans*) was very prevalent, the stems of the plants being attacked as severely as the foliage, or more so. Spraying or dusting is widely practised in Lincolnshire, but in other parts of England the losses are stated to be unnecessarily heavy. Common scab (*Actinomyces scabies*) was less prevalent than usual, but some severe cases of powdery scab (*Spongospora subterranea*) occurred on heavy soil in the north of England and in South Wales. Soil infection is regarded as the primary source of trouble with both these diseases, and no practicable method of disinfection on a large scale has yet been evolved.

The chocolate spot disease of field beans (*Bacillus lathyri : R.A.M.*, ii, p. 99) entailed serious losses in 1926. Severe epidemics were reported from the eastern and east midland counties in late May and June. In some cases the crops were total failures, but late-sown and backward stands remained comparatively healthy.

Celery blight (*Septoria apii*) was unusually widespread. Good results in the control of this disease by spraying with Bordeaux mixture have been obtained in the Haxey district of Lincolnshire.

The apple crop was an almost total failure, partly owing to meteorological conditions. Brown rot (*Sclerotinia fructigena*) was prevalent on the few fruit bearing apple trees. Czar and Rivers plums were also severely attacked by the disease (*S. cinerea and S. fructigena*) in the eastern and south-eastern counties.

Many acres of hops had to be abandoned on account of powdery mildew (*Sphaerotheca humuli*).

PETHYBRIDGE (G. H.). **Notes on** *Nectria Rubi*. *Trans. Brit. Mycol. Soc.*, xii, 20–23. 1927.

Dead and dying raspberry plants derived from two sources in Ireland in 1916 were found to bear perithecia of a species of Nectria, regarded as identical with *Nectria Rubi* Osterw., at the crowns and on the bases of the canes. A species of Fusarium, shown by cultural work to be connected genetically with the Nectria, was also present. Negative results only were obtained from a small series of inoculation experiments with pure cultures of the fungus.

PETHYBRIDGE (G. H.). **Mycology and Plant Pathology.** (Presidential Address.) *Trans. Brit. Mycol. Soc.*, xii, 91–105. 1927.

Reference was first made to the lists of fungi compiled at forays held, and the opinion expressed that the census of British species is reasonably complete and the time now come when more attention might be paid to the ecology and bionomics of fungi. The subject of plant pathology, particularly in relation

to its development in this country, was then considered. Its trend was indicated in a discussion of the opinions held from time to time concerning the relations of the host and parasite with one another and with varying external conditions. During the latter half of the 19th Century the importance of plant pests and diseases became increasingly recognised. The first Act of Parliament dealing with the protection of crops was passed in 1877, and with its revision and amplification in 1907 a small ad hoc inspectorate was appointed, which has since grown to considerable proportions. The greatest stimulus to plant pathology in this country, however, followed the provision by the State of greatly increased funds through the Development and Road Improvement Funds Act, 1909 and 1910, and subsequently through the Corn Production Acts (Repeal) Act of 1921. The main features of the existing organization for the study and practice of plant pathology in this country were subsequently detailed.

MINISTRY OF AGRICULTURE FOR NORTHERN IRELAND.

Muskett (A. E.) & Turner (E.). **The Control of American Gooseberry Mildew in Northern Ireland.** *Journ. Min. Agric. N. Ireland*, Vol. i, 1927.

American Gooseberry Mildew can be satisfactorily controlled in Northern Ireland by spraying. Two sprayings with polysulphide sprays have proved to be sufficient; the first should be applied immediately after flowering, and the second three weeks later. The first or early spraying is of great importance and should not be delayed. Home made spreaders and stickers such as skimmed milk and flour paste have given better results than proprietary materials used. Injury due to Gooseberry sawfly may be controlled by the addition of lead arsenate to these sprays. Alternative measures are given for varieties which are injured by polysulphide sprays. The question of resistant varieties and the cost of spraying in relation to the value of the crop obtained are considered.

(7) ANIMAL NUTRITION AND FEEDING STUFFS.

ANIMAL NUTRITION INSTITUTE, CAMBRIDGE.

HAMMOND (J.). **The Development of the Animal for Meat.** *Journ. Bath & West.* 1926–27.

This brief sketch is a popular account of an investigation into the production of mutton, which is being published in detail later. Some of the factors controlling quantity or growth in live weight are discussed and suggestion made for meat recording. The changes in the proportions of the body with age are illustrated and it is shown how these form the basis of quality. In the lamb at birth the head and legs are relatively large and the best joints such as the loins are relatively small in proportion. The extent to which these proportions change with age depends on the breed; although the wild sheep and unimproved breeds increase in weight with age, their proportions do not change so much as those of the improved mutton breeds. The rate at which an animal changes in proportions, not only as to outward form but also as to the component tissues of the body (bone, muscle and fat), is the determining factor in early maturity and is of more importance to the butcher than actual weight for age. The proportions of the body are also dependent upon nutrition ; badly fed animals have the conformation of similar animals of younger age, the earlier maturing parts of the body continuing to grow at the expense of the later developing and more valuable parts. The importance of the even distribution of fat throughout the carcase is also discussed. It is suggested that it is easier to make the best selection of breeding stock for meat production under conditions of good nutrition than under bad, for in the latter case the full capabilities of the animal for development are not brought out.

WOOD (T. B.). **The Production Requirement of Fattening Sheep.** *Journ. Min. Agric.*, Vol. xxxiv, No. 4. July, 1927.

This is defined as the weight of starch equivalent (or net energy) required to make 1 lb. of live weight increase. Three methods of investigation were used—statistical study of feeding trials, specially designed feeding trials, comparative slaughter. The results of the three methods agree. For sheep, six months old, folded on swedes, the production requirement for the first month is 2 lb. starch equivalent per lb. of live weight increase rising to $3\frac{3}{4}$ lb. after 5 months' feeding.

WOOD (T. B.). **The Farmer's Sheet Anchor.** *The Nineteenth Century and After.* Aug., 1927.

A review of the Live Stock Industry in which it is suggested that the comparative profitableness of milch cows and poultry is traceable to the fact that milk recording and trap nesting have given breeders and feeders a measure of production which is lacking in the case of pigs, beef cattle and sheep. It is further shown that the ratio of coarse fodder to concentrates available in Great Britain is 3 to 1. It is suggested that this fact limits intensity of production. The remedy indicated is improved pasture management.

WOODMAN (H. E.) & AMOS (A.). **The Losses in the Tower Silo.** *Journ. Agric. Sci.*, part iv. Oct., 1926.

This publication gives an account of an investigation which had as its object the measurement of the average losses of nutrient matter during the preservation of green crops in the tower silo. It was demonstrated that the attainment of such high temperatures as are necessary for the production of "sweet" silage does not necessarily involve an excessive loss of the dry matter as a consequence of the acidation of carbohydrate. "Acid brown" silage can be made in the tower silo with an average loss of dry matter equal to

5 to 6 per cent. of that contained in the green crop. The production of "sweet" silage under good conditions entails average dry matter losses of the same order, whereas the losses in making "green fruity" silage are somewhat higher, namely of the order of 8 to 9 per cent.

When a silo is filled with crops of fairly uniform moisture content, the lowest losses of dry matter occur in the middle layers of the column of silage. The losses may be excessive when the silo is filled with very sappy or rain-laden crops, or when a mass of wet material is superimposed on a crop which has been ensiled at a suitable moisture content. For the purpose of making silage of good quality, and at the same time of keeping down the losses to a minimum, the optimum dry matter content of the green crop appears to lie in the region of 26 to 34 per cent.

Woodman (H. E.) & Stewart (J). **The Composition of Flaked Maize.** *Journ. Agric. Sci.*, Part i. Jan., 1927.

This paper records an investigation into the organic and mineral composition of several commercial brands of flaked maize. It was shown that flaked maize as made by the different manufacturers at the present time is a reasonably uniform product.

Woodman (H. E.). **The Mechanism of Cellulose Digestion in the Ruminant Organism.** *Journ. Agric. Sci.*, xvii, 333, 1927.

In this paper, a theory is propounded in connection with the digestion of cellulose by ruminants which is compatible with Kellner's experimental finding as to the productive value of digested fibre. It is shown that, under the influence of cellulose-splitting bacteria, a given weight of digestible fibre yields as much glucose to the organism as does an equal weight of starch.

Woodman (H. E.) & Bee (J. W.). **The Nutritive and Manurial Values of Sugar Beet Tops.** *Journ. Agric. Sci.*, xvii, 477, 1927.

An investigation is described into the composition, digestibility and nutritive value of sugar beet tops from the beet crop grown on the University Farm during the season of 1926. It is shown that the tops constitute a valuable food of high digestibility. 25 lb. of tops (16·2 per cent. dry matter) are able to replace 40 lb. of mangolds (10·7 per cent. dry matter) in the rations of live-stock.

Numerous samples of sugar beet tops were collected from a large number of farms distributed over the Eastern Counties. The samples were submitted to mineral analysis and reliable data were obtained for calculating the manurial value of sugar beet tops when ploughed into the land or, alternatively, when consumed on the land by farm stock.

Woodman (H. E.), (Blunt (D. L.) & Stewart (J.). **Nutritive Value of Pasture. II. Seasonal Variations in the Productivity, Botanical and Chemical Composition, and Nutritive Value of Pasturage on a Heavy Clay Soil.** *Journ. Agric. Sci.*, xvii, 209, 1927.

This paper deals with an investigation which was essentially a continuation of earlier work carried out in 1925 and was designed to ascertain whether, under greatly differing conditions in respect of soil, herbage and weather, the results obtained in the 1925 investigation concerning chemical composition, digestibility and nutritive value of pasture herbage, under a system of cutting resembling the conditions of close grazing, still held good. The results of this investigation afforded an affirmative answer and the main conclusion was drawn that, under a system of close grazing, pastures yield, irrespective of

botanical composition, a herbage whose dry matter partakes of the character of a protein concentrate of high digestibility and nutritive value. Moreover, close grazing enables this productive character to be retained throughout the entire season.

NATIONAL INSTITUTE FOR RESEARCH IN DAIRYING.

GOLDING (J.) & MORRIS (W. B.). **Some experiences in the course of pig feeding experiments at the National Institute for Research in Dairying.** *Pig Breeders' Ann.*, 1927–28.

The paper describes developments in the experimental buildings at the Institute. A new technique for individual feeding is described for the first time with illustrations of the method and of the feeding pens used.

A disease causing the death of thirteen young pigs and illness of others, was traced by Professor J. Basil Buxton to an infection by *Strongylus rubidus* in conjunction with an invasion of *Coccidia*.

Some parasitic diseases of pigs including the above are described in the same publication by Professor Buxton.

PROCTER (F.) & WRIGHT (N. C.). **Bulk in animal feeding.** *Journ. Agric. Sci.*, xvii, Pt. iii, 1927.

As a result of soaking in water at body temperature (38° C.), foods show variations in swelling ranging from approximately 10 per cent. to 260 per cent.

The volumes of equal weights of different foods after soaking also vary within wide limits. The percentages of moisture in the soaked foods show corresponding variations, being in some cases as high as those found in roots or green fodder.

These facts have led the authors to put forward a new conception of "bulk" in assessing the value of a ration.

Feeding experiments have been carried out to determine how far this factor of bulk is applicable in practice.

In the case of pigs of 40 to 80 lb. live weight, the bulk occupied by the foods did affect the quantity of food taken. With calves, the swelling capacity of the concentrated food did not yield any definite results so far as food consumption was concerned.

ROWETT RESEARCH INSTITUTE.

CRICHTON (J. A.), FARQUHAR (R. W.) & BISSET (G. B.). **Russian Sunflower Seed Cake.** *Scott. Journ. Agric.*, Vol. x, No. 1.

This paper gives the results of experimental work on pigs to test the nutritive value of sunflower seed cake. Large quantities of this cake are produced cheaply in Russia, but up till the present it has not entered to any extent into the feeding practice of farmers in this country. In composition it is of about the same value as other protein-rich substances, such as extracted soya bean. A preliminary experiment showed that sunflower seed cake could be used for feeding pigs up to at least 15 per cent. of the ration. A second experiment was carried out to compare sunflower seed meal with soya bean meal and decorticated earth nut meal. Four groups of eight pigs were each fed a basal ration of cereals and fish meal, with varying additions of earth nut meal, soya bean meal and sunflower seed meal.

The results seem to show that sunflower seed cake can be used to replace extracted soya bean meal and decorticated earth nut meal in the rations of pigs, and if the product can be obtained at a rate substantially less than

these concentrates, it would appear to be advantageous to the pig-feeder to use it.

FOSTER (J. W.). **Pica.** *Kenya and E. African Med. Journ.*, iv, No. 3, June, 1927.

This is a résumé of the literature on the subject of pica or perverted appetite in animals and human beings and the relationship which pica appears to bear to diet is discussed. Pica is commonest during pregnancy, lactation, and the growth period when the demands of nutrition are greatest. The symptoms of pica, a craving for abnormal substances are indicative of a dietary deficiency and it is suggested that at least in the case of animals this deficiency lies in the inorganic constituents of the diet.

HUSBAND (A. D.) & GODDEN (W.). **The Determination of Sodium, Potassium and Chlorine in Foodstuffs.** *The Analyst.* 1927.

A technical paper, the original of which should be consulted for the method, embodying the experience obtained in applying certain methods to the analyses of foodstuffs and animal excreta. The modifications suggested have been worked out and adopted after testing several methods described in the literature.

LEITCH (I.) & HENDERSON (J. McA.). **The Estimation of Iodine in Foodstuffs and Body Fluids.** *Biochem. Journ.*, Vol. xx, No. 5.

The study of iodine metabolism has been retarded by the technical difficulty of estimating accurately the small amounts of iodine which occur in foodstuffs and in tissues and body fluids.

Kendall's method, while admirably suited for the analyses of thyroid tissue, which contains fairly large amounts of iodine, is unsuitable for estimating the iodine in human blood and milk.

Fellenberg's method is more delicate, but involves both a colorometric and titrimetric estimation, and a modification is given in this paper whereby the colorometric part of the estimation is eliminated. In this form, the method is much simpler and has been found to give excellent results for routine work on blood, milk and pastures. For the method, which is highly technical, the original paper should be consulted.

LEITCH (I.). **The Effect of Anaesthetics on Blood Iodine.** *Intern. Goitre Conference*, Bern, Aug., 1927.

The iodine content of the blood of goats and of human beings was estimated before and after administration of various anaesthetics. Results show that in some cases a marked rise or fall in blood iodine occurs, a fall usually occurring under chloroform and a rise under ether. These results appear to be of clinical importance, and the investigation is being continued.

LEITCH (I.). **Variations in Blood Iodine associated with Changes in Ovarian Activity.** *Intern. Goitre Conference*, Bern, Aug., 1927.

A study of blood iodine in female goats over a long period has shown that changes occur in the level of blood iodine and that these changes appear to be associated with the sexual cycle. Blood analyses have shown that a rise in blood iodine occurs during heat. During pregnancy the level of blood iodine is steady and remains low till before parturition when a rise occurs. This is of interest in view of the well-known interaction between thyroid and ovarian function.

MAGEE (H. E.) & REID (C.). **Studies on the Movements of the Alimentary Canal: The Effects of Electrolytes on the Rhythmical Contractions of the Isolated Mammalian Intestine.** *Journ. Physiol.*, Vol. lxiii, No. 2.

This paper deals with the effects of varying the ionic concentration of the environment on the isolated small intestine of the rabbit.

The following conclusions have been drawn:

(1) The osmotic and specific effects of sodium were closely associated. Within limits, the amplitude of contraction was directly proportional to the concentration of sodium. Excess of sodium increased the tone and diminished the amplitude.

(2) The rate varied directly as the ration Ca/K. Calcium progressively increased the tone.

(3) Three concentration zones of action of potassium were distinguished with 0-0·22 per cent. KCl, tone was lowered and contractions abolished. These recovered after several minutes' delay. With 0·02-0·06 per cent. KCl, the amplitude was augmented, the rate slowed and the tone generally unaffected.

Above 0·06 per cent. KCl, tone was increased and amplitude and rate diminished.

(4) Calcium almost completely antagonised potassium.

(5) The optimal pH zone was pH 7 to pH 8. Below pH 7 tone and rate were lowered and contractions were very irregular. Above pH 8 tone and rate were distinctly, and amplitude slightly, lowered.

(6) Magnesium, although not absolutely essential for contractility, appeared to have a regularising influence on the contractions.

(7) The phosphate ion in excess stimulated tone and lowered the amplitude and rate.

(8) Iodine in low concentrations (up to 0·26 per cent. NaI) increased the amplitude and in higher increased tone and rate but diminished the amplitude.

(9) Low concentrations of manganese (0·0008 per cent. $MnCl_2$ temporarily stimulated contractions: higher concentrations (0·002 per cent. $MnCl_2$) depressed them.

ORR (J. B.), SCOTT ROBERTSON (G.), KINROSS (Miss A.), LEWIS (Miss G.) & NEWBIGGIN (Miss H.). **The Nutritive Requirements of Poultry. VII. Note on Growth in Chickens.** *Scott. Journ. Agric.*, Vol. ix, No. 4.

This is the seventh of a series of papers dealing with the nutritive requirements of poultry, and embodies the results of joint experimental work carried on at the Rowett Institute, The Edinburgh and East of Scotland College of Agriculture, Glasgow and West of Scotland College of Agriculture, Ministry of Agriculture for Northern Ireland and the Rural School of Domestic Economy, Craibstone.

A series of experiments was carried out to show the increased rate of growth produced by the addition of whole milk to ordinary chicken rations, and also to see what proportion of this increase could be obtained by the use of either separated milk or protein plus a mineral salt. Groups of chickens, three or four days old, were fed on a ration of cereals and cereal-products. One group was given this basal ration with no addition. To the ration of each of the other groups was added either whole milk, separated milk or meat and bone meal.

The results show that in every case the groups receiving milk grew faster than those receiving no milk, while the gain in weight of the group receiving separated milk was even greater than that in the group receiving whole milk. This supports the conclusion of a previous paper that excess of oil or fat in the food of chicks may be harmful.

The rate of growth on the ration containing meat and bone meal was definitely greater than that in the basal ration without addition. It was not so great, however, as that on the ration containing milk.

The addition of linseed meal to the basal ration had little effect on growth. Linseed meal plus mineral salts increased the rate of growth, but the increase was less than half that produced by milk.

Orr (J. B.) & Crichton (A.). **Review of the Recent Work on the Nutrition of the Pig.** *Trans. Highland and Agric. Soc.*, 1927.

This paper gives an account of some modern aspects of pig feeding. The energy, vitamin and mineral requirements of the pig for normal health and growth are discussed as is also the value of ultra-violet light in stimulating the assimilation of mineral matter. The most recent experimental work is quoted on methods of pig feeding including the latest results on such problems as indoor and outdoor feeding, wet and dry, the advantage or disadvantage of heating food and the free choice system of feeding.

Richards (M. R.), Godden (W.) & Husband (A. D.). **The Influence of Variations in the Sodium-Potassium Ratio on the Nitrogen and Mineral Metabolism of the Growing Pig. II.** *Biochem. Journ.*, xxi, No. 4, 1927.

The addition of potassium citrate to a ration of cereals fed to growing pigs led to decreased assimilation and retention of nitrogen, phosphorus and calcium. The increase of potassium caused immediate increase in urinary chlorine followed by a decrease after which the high intake of potassium had no effect on excretion. The withdrawal of potassium caused an immediate drop in urinary chlorine followed by an increase. The results obtained with regard to sodium excretion do not support the theory of sodium impoverishment put forward by Bunge as the result of experiments on himself.

UNIVERSITY OF READING.

Davies (W. L.). **The Quality of the Protein of Whale Meat Products.** *Journ. Soc. Chem. Ind.*, xlvi, No. 10, p. 99t.

Whale meat flakes and whale meat meal were examined with reference to the composition of the water-soluble nitrogen fraction; 20 per cent. of the nitrogen of the former and 37 per cent. of the nitrogen of the latter were water-soluble, a fact which necessitated the study of the composition of the soluble nitrogenous compounds. For both samples, the diamino acid contents (by the Kossel and Kutscher method) of the aqueous extracts and of the water-extracted samples were determined. The compositions of the aqueous extracts compared favourably with those of the extracted meal and flake, and, indeed, with the composition of any complete protein. Compared with the aqueous extracts of some fish meals, the extracts of these products are slightly poorer in content of diamino acids, but whale meat products have the advantage of containing very little soluble nitrogenous bases. Examination of the fraction of nitrogen other than diamino nitrogen by alcohol titration methods showed that the nitrogen was mostly that of normal protein degradation products.

The meat meal, as shown by its high soluble nitrogen, must have been prepared by more drastic methods than the flake meal, the latter being also a more presentable feeding stuff. The flake stored better than the meal under ordinary storing conditions. The meat had a strong tendency to grow mouldy and knit into lumps.

DAVIES (W. L.). **The Proteins of Green Forage Plants. III. The Proteins of Forage Plants of the Natural Order Cruciferae (genus *Brassica*). Comparison with Colzalin, a Globulin from Rapeseed.** *Journ. Agric. Sci.*, xvii, 33.

Protoplasmic proteins from fully grown samples of cabbage, marrow stem kale (stem and leaves separately), kohl rabi, leaves and roots of turnip were isolated by ether-water cytolysis of the vegetable tissue followed by heat coagulation of the proteins thus liberated. Another fraction of protein was isolated from the ether-water extracted cabbage and turnip leaves by hot alkaline alcohol extraction. All proteins were further purified and isolated in a dry friable state by successive alcohol dehydration and ether treatment and samples of high purity were obtained. The nitrogen distributions (van Slyke method) of these proteins were determined.

The ether-water extracted proteins of all brassicaceous plants showed almost identical nitrogen distribution, which showed that there was no difference in the composition of protoplasmic protein within that genus. The alcohol alkaline fraction showed a different composition. All the proteins were characterised by high arginine and lysine fractions with low amide nitrogen.

To compare with the composition of protoplasmic protein, a globulin, colzalin, was isolated from rapeseed meal by saline extraction and heat coagulation. This protein was isolated in a pure state and analysed by the van Slyke and the Kossel and Kutscher method. The nitrogen distribution of this protein was similar to that of the brassicaceous proteins except for a high amide nitrogen content as is usual for seed proteins. High arginine and lysine contents were also found by the Kossel and Kutscher method.

DAVIES (W. L.). **The Proteins of Green Forage Plants. IV. The Proteins of some Plants of the Natural Order Umbelliferae.** *Journ. Agric. Sci.*, xvii, 41.

Proteins from healthy well-grown specimens of carrots and parsnips were isolated by similar methods to those described for brassicaceous plants. It was found more difficult in this case to obtain pure samples of protein. The samples were analysed by the van Slyke method. Arginine and histidine nitrogen were found to be high, but the amounts of these fractions of nitrogen differed in the two proteins. Nevertheless, the sums of the two fractions were almost identical. The other fractions of nitrogen were almost identical throughout. In both cases ammonia and the diamino acids accounted for about 20 per cent. of the proteins.

Tables are given in this paper of the analysis of the preparations and of the distributions of the nitrogen in the carrot and parsnip roots.

DAVIES (W. L.) & SULLIVAN (R. S.). **The Nutritive Value of Dried Spent Hops.** *Journ. Agric. Sci.*, xvii, 380–7, 1927.

The nutritive value of dried spent hops, a by-product useful as a "filler" to absorb liquid waste foods, has been determined by feeding to three sheep and determining the digestibility of the material. The by-product is not readily taken to by sheep—up to only one-seventh of the dry matter of the ration. The material has high crude protein, ether extract and mineral matter, but the digestibilities of the constitutents are low, the production starch equivalent being 24·5. As a result of the experiment it was observed that the spent hops depressed the availability of the mineral constituents of the basal ration. The ether extract was rich in hops oil, was easily decomposed by heat, and contained an appreciable amount of unsaponifiable matter.

DAVIES (W. L.). **The Titration of Protein Hydrolysates.** *Biochem. Journ.*, 21, 215–222, 1927.

This is an analytical paper extending the idea of alcohol titration of amino acids towards simplifying protein analysis. The occurrence of difficulties in estimating the amino nitrogen of diamino acids can be overcome by doing a simple titration in alcoholic-formalin solution, in which case more uniform results are obtained, also. By this method, results more in agreement with the accurate Kossel and Kutscher method of estimating diamino acids are obtained by the van Slyke principle of protein analysis.

WELSH PLANT BREEDING STATION.

STAPLEDON (R. G.) & JONES (M. G.). **The Sheep as a Grazing Animal and as an Instrument for Estimating the Productivity of Pastures.** *Welsh Plant Breeding Station Bull.*, Series H, No. 5, p. 42. Mar., 1927.

Sheep were penned on controlled plots for stated periods and kept under continuous observation for spells of 24 hours at a time. By a system of control plots and cutting after the sheep the amount of herbage eaten by the experimental sheep for 24 hours was ascertained.

The yield per acre per annum of the temporary pasturage experimented with was 12·66 tons of green grass devoid of extraneous moisture. The amount eaten per 24 hours by a sheep varied within wide limits—more was eaten when the herbage consisted largely of clover stem than when it consisted predominantly of clover leaf. The amount eaten per day varied from 9·5 lb. to 24·2 lb. of green grass. The sheep penned on an abundant herbage spent about half their time (over the 24 hours) feeding, grazing and chewing the cud, and about half their time resting.

MINISTRY OF AGRICULTURE FOR NORTHERN IRELAND.

BASKETT (R. G.). **The Value of Mineral Supplements to the Breeding Sow.** *Journ. Min. Agric. N. Ireland*, Vol. i, 1927.

Cases have been encountered in which breeding sows, kept on farms where separated or buttermilk is not available, have produced small undersized litters of unthrifty pigs. An experiment was carried out with a group of seven sows producing this type of litter. The addition of a mineral mixture, made up of ground chalk, steamed bone flour, common salt, iron oxide and sulphur, was made to the same ration as that fed previously. This mineral addition had a very marked effect on the subsequent litters. Before the feeding of minerals the percentage of deaths prior to weaning was 63·0 per cent., and the average number of pigs per litter at birth 7; after feeding a mineral mixture the percentage of deaths was reduced to 25·4 per cent. and 16·2 per cent., and the average number of pigs per litter at birth was 9·1 and 8·7, respectively, in the two litters subsequent to the addition of a mineral mixture.

BASKETT (R. G.). **Mineral Supplements and Vegetable Protein in Bacon production.** *Journ. Min. Agric. N. Ireland.* Vol. i, 1927.

This paper deals with an experiment with fattening pigs which was designed in order to obtain information on the following points:—(*a*) The value of mineral supplements to a normal ration for fattening pigs; (*b*) whether a mineral mixture is necessary when separated milk is available; (*c*) if animal protein (in the form of fish meal) has any superiority over vegetable protein (in the form of extracted soya bean meal).

Three groups (24 pigs in each group) were fed on the following rations:— Group I. Basal ration plus soya bean meal. Group II. Basal ration plus soya bean meal, plus a mineral mixture. Group III. Basal ration plus fish meal.

Separated milk was fed to all three groups during the first month of the experiment.

The results of the experiment may be summarised as follows:—

(1) No benefit was found in feeding a mineral mixture when separated milk was available.

(2) When separated milk was not available better live weight gains were made by Group II, receiving a mineral mixture, than by Group I.

(3) Equally good live weight gains were made by Group II (soya bean meal plus mineral mixture) as Group III (fish meal), and it seems that the value attached to fish meal is due rather to the high mineral content than to any superiority of animal protein over vegetable protein.

Robertson (G. S.), Dickinson (F.) & Houston (J.). **Silage Investigations.** *Journ. Min. Agric. N. Ireland*, Vol. i.

Contains a record of experimental work over a period of four years on (*a*) the making of silage; (2) the feeding value of silage for milch cows and fattening cattle; and (3) an investigation of the changes which take place in the silo and their influence on the feeding value of the resulting silage.

In the feeding experiments the hay and roots fed to the control groups were adjusted so that the dry matter, digestible protein and starch equivalent of the two rations were comparable. The results showed that when first quality silage was fed at the rate of 50 lb. per head it was possible to effect a saving of 6 lb. of hay and 2 lb. of a balanced mixture of concentrates per head of cattle. On the other hand if the fermentation changes in the silo are not properly controlled the feeding value for dairy cows may be less than a corresponding weight of roots. The nature of these changes and the factors controlling them are discussed.

(8) ANIMAL BREEDING

(including Physiology of Reproduction).

ANIMAL NUTRITION INSTITUTE, CAMBRIDGE.

ASDELL (S. A.) & MARSHALL (F. H. A.). **On the Effect of the Ovarian Hormone in Producing Pro-œstrous Development in the Dog and Rabbit.** *Proc. Roy. Soc,* B, Vol. ci. 1927.

Injections of an alcoholic extract of liquor folliculi produce typical pro-œstrus changes in the uterus and vagina of the bitch during the anoestrous period (that is, at a time when the uterus is normally quiescent). Somewhat similar changes can be brought about in the uterus and vagina of the rabbit. Since the females in the experiments showed no inclination to accept the male it is possible that in the actual production of oestrus a further factor than the follicular hormone may be involved.

ASDELL (S. A.) & BUCHANAN-SMITH (A. D.). **Some Practical Observations on the Inheritance of Colour, Beard and Tassels.** *Brit. Goat Soc. Year Book.* 1927, p. 129.

An extensive series of records and photographs was analysed for information on the Mendelian inheritance of colour, beard and tassels in the goat. Results showed that there are two series, a red and a dominant black colour series. These are each subject to the action of cominent dilution factors, producing in the one case red, sandy, cream, white, and in the other black, chocolate. fawn, white. Brown and grey are dominant over the two series. Beard is inherited, being expressed, when present, in single factor in the male and double in the female. Tassels are inherited as dominant but the mode of inheritance cannot be expressed as a single factor difference.

ASDELL (S. A.). **Time of Conception and of Ovulation in Relation to the Menstrual Cycle.** *J.A.M.A.*, 1927–, 89, p. 509.

Data collected while at Rochester, N.Y., on the time of fertile coitus in the human menstrual cycle. Fertility is high in the early part of the cycle but falls rapidly from the sixteenth to the twentieth day. There is little evidence in favour of a period of complete sterility.

Differences in the duration of pregnancy when reckoned from the onset of menstruation and from conception are interpreted as indicating that the pre-ovulation (follicular) phase is extremely variable in its length, and that the post-ovulation (corpus luteum) phase is relatively constant. It is on these lines that an interpretation of variation in the length of the menstrual cycle may be sought.

HAMMOND (J.) & ASDELL (S. A.). **The Vitality of the Spermatozoa in the Male and Female Reproductive Tracts.** *Brit. Journ. Exp. Biol.*, iv. Dec., 1926.

Methods and experiments are described for testing the length of fertility of the sperms in the male and female tract of rabbits. The sperms may retain their fertility in the male tract up to 38 days, but in the female tract only up to 30 hours.

In cases when the sperms had remained in the female tract for 24–30 hours before ovulation small litters were frequently produced; it is suggested that this is due to the end point of the vitality of the sperms falling within the limits of time during which the process of ovulation occurs.

The bearing of these results on problems of fertility and sterility is discussed. The relatively long life of the sperm in the male tract suggests the possibility of keeping them alive for some time outside the body when the conditions of life are properly understood, while the relatively short life in the female tract suggests possible causes of sterility in such animals as the mare when the length of the heat period is great.

HAMMOND (J.). **Reproduction in the Cow.** *Cambridge University Press*, 1927.

This book gives the results of an investigation into the physiology of breeding and the development of the udder in the cow together with a summary of the literature of the subject.

The time of calving of cows under different agricultural conditions is dealt with statistically, and it is shown that there is a delay in getting cows which calve in the late autumn months served, this causing an unequal distribution of down-calving cows and consequently milk supply throughout the year.

By the use of a vasectomised (sterile) bull the duration of the heat period and the times between one heat and the next were measured in a number of heifers at different periods of the year, and under different circumstances. It was found that the length of the heat period was shorter during the winter months than in the summer; this, and the fact that the signs of heat are not so marked, probably accounts for the difficulty in getting cows in calf quickly during the winter months.

The effect of drugs and other factors on the length of heat and duration between one heat and the next were also studied; these had very little effect except that of removing the corpus luteum, in which case the cow was brought on heat again within two days after its removal. The duration of the corpus luteum therefore controls the length of the œstrous cycle. Not only does the removal of the corpus luteum shorten the length of the cycle but it also shortens the subsequent heat period; this fact is of fundamental importance as regards the cause of heat.

The changes occurring in all the reproductive organs at different stages of the œstrous cycle are described. The egg is shed some time between 30 and 48 hours after the beginning of heat, and bleeding from the vulva takes place in most heifers, but in few cows 48–72 hours after the beginning of heat. Large quantities of fluid slime (mucus) are secreted from the cervix at heat, but during the remainder of the cycle only a little tenacious mucus is present. During pregnancy a large accumulation of very thick sticky mucus seals the entrance to the cervix.

A description is given of the reproductive organs at the end of each month of pregnancy, and the methods of diagnosing pregnancy are discussed. Various causes of sterility have been investigated and discussed.

Illustrations are given of the development of the udder from the fœtal stages, in which it originates from a fold in the skin, to the fully found gland of a cow at the end of lactation. The size of the udder may vary independently of the amount of glandular tissue it contains. In the virgin heifer the bulk of the udder consists of fat which is replaced by glandular tissue as the udder grows during the first pregnancy. This growth which commences about the twentieth week after conception is associated with the formation of a thick sticky yellow fluid (rich in globulin) which can be drawn off from the teats and which, mixed with the milk found at a latter stage, forms colostrum. The causes which affect the growth of the udder are also discussed.

HAMMOND (J.). **Uterine Grafts.** *Brit. Journ. Exp. Biol.*, 4, June, 1927, p. 349.

In order to test whether the corpus luteum of pseudo pregnancy could be made to persist and the mammary glands to develop as in pregnancy, foetal tissues were transplanted into the pseudo pregnant uterus of the rabbit. The grafts grew but were without effect on the corpus luteum and mammary gland. The foetal tissues only grew where they were attached to the muscle layer of the uterus although every effort was made to attach them to the mucosa. Since the parts of the grafts lying in connection with the mucosa were absorbed rather than nourished and since the introduction of living foetal tissue failed to cause any further development of the deciduometer which was produced by cutting the pseudo-pregnant mucosa, it is suggested

that normally the attachment of the foetus is caused by the active erosin (digestive) agency of the foetal trophoblast, a function which is absent in the cells of the foetus itself.

MARSHALL (F. H. A.) **The Conditions Governing Parturition.** *Biol. Rev.*, Vol. ii, No. 2. Mar., 1927.

This paper reviews the recent literature on the subject. The duration of gestation depends upon a number of conditions which, though generally constant within a particular species, vary widely in different species and even in closely related forms. Of the different factors which contribute to the immediate cause of parturition the phase of the ovarian rhythm is one of the most important. In view of the specific influence of pituitary extract on the muscles of the uterus it is probable that this gland plays a part in parturition and experimental evidence has shown that there may be a functional correlation between the ovary and the pituitary. It has also been shown that the degree of development of the uterine muscle is a factor in parturition. The development of the foetus *in utero* may be a factor in the stimulation of the uterine muscles.

The integrity of the uterine and abdominal nervous systems is essential for the expulsion of the foetus but parturition may abnormally occur in the absence of this integrity. Similarly, parturition may abnormally occur in the absence of the complete endocrine mechanism, and it is possible that compensatory mechanisms may come into being when the normal ones have been experimentally interfered with.

MARSHALL (F. H. A.) **On the Proestrum and Pseudo-pregnancy.** *Journ. Exp. Physiol.*, Vol. xvii, June, 1927.

The paper consists of a short comparative study of the successive phases of the oestrous cycle in various mammals considered in the light of recent research. It is shown that the phenomena of the proestrum (or stage of "coming on heat") may occur independently of there being a corpus luteum in the ovary and that the earlier changes (in particular hyperaemia in the uterus) may be brought about artificially by the injection of ovarian extracts. Pseudo-pregnancy on the other hand, whether it occurs normally in the bitch or under experimental conditions as in the rabbit, is due to the influence of the corpus luteum.

WATSON (A.) **The Relation between "Density" of Sperm Suspension and Fertility as determined by Artifical Insemination of Rabbits.** *Proc. Roy. Soc., B*, Vol. 101, 1927.

Experiments on artificial insemination of rabbits show that fertility is influenced by the density or number of spermatozoa introduced into the vagina of the female.

The percentage fertility is reduced where the estimated number of spermatozoa is less than about 106 per 3 c.c. Sterility occurs where the number is below 104 per 3 c.c.

Three factors probably play a part in determining the results but are not subject to quantitative estimation: (*a*) The probability of any one spermatozoon reaching the fertilizable ovum is small; (*b*) the spermatozoa are variable and not all capable of fertilization; (*c*) toxicity may act differentially on sperm suspensions of varying density.

These experiments bear more particularly upon the problem of fertility in the male and provide a possible explanation of the variability of different sires in their capacity to produce offspring. It is suggested that a sire which is a "good getter" is one which produces a large number of fully active spermatozoa.

SMALL ANIMAL BREEDING RESEARCH INSTITUTE, CAMBRIDGE UNIVERSITY.

PUNNETT (R. C.) & PEASE (M. S.). **Genetic Studies in Poultry. V—on a case of pied plumage.** *Journ. Genet.*, Vol. xviii, pp. 207–18.

The "pied" character, a mixture of coloured, part-coloured, and pure white feathers (such as occurs in the Exchequer Leghorn), behaves as a simple recessive to self coloured plumage. Pied chicks show a great deal more white in the down than normal blacks.

An excess of white in the down may, however, be quite independent of the pied character, occurring in chicks which develop into normal blacks. Such "white" downs are recessive to normal black downs, though the grade of pigmentation is probably complicated by a modifying factor or factors.

The bearing of these facts is discussed in connection with certain difficulties sometimes met with in making use of the sex-linked cross, barred hen by black cock.

JOHN INNES HORTICULTURAL INSTITUTION.

HALDANE (J. B. S.). **The Comparative Genetics of Colour in Rodents and Carnivores.** *Biol. Rev.*, II, 3, pp. 13. 1927.

A survey of the genetics of colour in various mammals, showing the existence of homologous variations.

ANIMAL BREEDING RESEARCH DEPARTMENT, UNIVERSITY OF EDINBURGH.

AMEMIYA (I.). **Hermaphroditism in the Portuguese Oyster.** *Proc. Roy. Physic. Soc.*, v. 21, pp. 97–100.

The Portuguese Oyster belongs to the dioecious group of oyster, but out of seventy-five individuals kept under observation two were hermaphroditic. It is suggested that this was due to variation in the amount of available nutriment.

BLYTH (J. S. S.). **Studies on the Fleece Fibres of British Breeds of Sheep.** *Zeit. Tierz.*, Vol. vii, pp. 97-100. 1926.

Two main types of fibre occur in British breeds of sheep. Type 1 is proportionally the longer and coarser and exhibits characteristic reticulate scale markings. It appears to occur only in the Lustre and Mountain Long wool groups of breeds. Type 2 is shorter and finer and possesses a coronal type of scale marking; it occurs in all breed groups. It constitutes the main type in the Short Wools, and is present in varying proportion in the Mountain Longwools and the Lustres. In some samples of the latter group, however, its component fibres are very few in number.

Two small subsidiary classes are also found, kemp, and a group of very fine short fibres which are not wholly separable from Type 2 owing to their great similarity.

Type 1 and kemp are homologous with the hair of primitive breeds and primitive wool is represented by Type 2 and the small group of fine fibres. Medulla is very variable, probably owing to environmental as well as hereditary influences. It occurs more frequently in mountain than in non-mountain breeds.

BLYTH (J. S. S.). **Kemp Fibres in the Fleece of British Breeds of Sheep.** *Journ. Text. Inst.*, v, 17, pp. 1291–1295.

Kemp is defined and described and its origin given.

Modifications of the normal type of Kemp are discussed, and variations which are typical of four groups of sheep breeds are described. Coloured kemps are briefly referred to.

Two normal types of kemp fibres are described.

It is suggested that kemp is homologous with the hair of primitive breeds of sheep.

CHAUDHURI (A. C.). **Age and Quality of Offspring.** *Journ. Hered.*, Vol. xvii, pp. 368–370. 1926.

From a study of the first five prize-winners of each Shorthorn class at the Highland and Agricultural Society's shows during the period 1902–1925, it would appear that the age of the parents does not influence the quality of the offspring.

CREW (F. A. E.). **An Attempt to Disturb the Sex-ratio in the Mouse by the Continued Administration of Alcohol to the Male Parent.** *Proc. Roy. Physic. Soc.*, vol. xxi, pp. 89–96. 1926.

Alcohol fumes administered to male mice did not, in this experiment, evoke a disturbance of the sex-ratio among their offspring.

CREW (F. A. E.). **An Achondroplasis-like Condition in the Sheep.** *Vet. Journ.*, vol. lxxxii, pp. 598–601. 1926.

A purebred Shropshire twin ram lamb was born dead and exhibited abnormalities which are components of the general condition of achondroplasis found in cattle, and the human subject. The female co-twin was normal. It is inferred that the achondroplasis-like condition is of genetic origin. The interest of the case is mainly that it shows the hereditary constituents of acondroplasia to be present in sheep, and that deliberate selection for a type in which the limbs are as short and the head as broad as possible might increase the incidence of "bull-dog" lambs.

CREW (F. A. E.). **The Science of Genetics and its Application to Stockbreeding.** *Journ. Univ. Coll. Wales.* 1926.

A short history of the science precedes the main part of the paper in which it is shown how success in stockbreeding must be severely limited unless the science of genetics is brought to bear in its practical application to the breeder's problems. The manner in which the geneticist has already helped the breeder and the manner in which he will yet do so are also discussed.

CREW (F. A. E.). **Recent Advances in Genetics : The Chromosome Theory of Inheritance.** *Agric. Prog.*, vol. iv. 1927.

The mechanism by which hereditary characteristics are transferred from parent to offspring is discussed and the present limitations of genetical knowledge are sketched. The difficulties of using the lessons learned from a study of Drosophila in practical application to stockbreeding are indicated.

CREW (F. A. E.). **On Fertility in the Domestic Fowl.** *Proc. Roy. Soc. Edin.*, v, 66, pp. 230–233.

The onset of fertility varies but is usually either 24–48 hours after the introduction of the male.

Sperm live 15–20 days within the female.

Fertility endures 15–20 days after removal of male, but eggs laid after first week usually fail to develop.

If a second male is introduced the influence of the first is removed by the 7th to the 10th day. There is a relation between the vigour of the individual and the fertilising power of his sperm.

CREW (F. A. E.) **An Equine Lithopedion.** *Vet. Journ.*, v, 82, pp. 261–263.

The position of the Lithopedion and its markings are described.

It is suggested that it was a foetus corresponding to a pregnancy previous to that which resulted in its discovery.

The process is described by which one foetus of twins sometimes dies and becomes converted into a lithopedion.

CREW (F. A. E.). **Note on a Sexually Abnormal Camel.** *Vet. Journ.*, v. 82, pp. 311–313.

In the case discussed the differentiation of the sex equipment remained imperfect owing to the late development of the testes.

CREW (F. A. E.). **A Note on a Case of Peculiar Surgical Emphysema in a Fowl.** *Vet. Journ.*, v, 82, pp. 480–482.

After a thyroidectomy operation the subcutaneous tissues of an adult Campine Cock became tensely distended with air. The wattles were involved and it is suggested that these are hollow sacs usually closed. This may be a clue to the mechanism by which a turkey cock erects his head appendages.

CREW (F. A. E.). **Abnormal Sexuality in Animals. I. Genotypical.** *Quart. Rev. Biol.*, v, 1, pp. 315–359.

Cases of Genotypical abnormal sexuality are divided into two main groups and these in turn are subdivided into subsidiary groups. The cases are systematically reviewed.

GREENWOOD (A. W.). **A Case of Congenital Bilateral Stenosis of the Epididymus in the Goat.** *Vet. Journ.*, v, 82.

The history of the goat is given and the naked eye characters of the genital organs described.

Details of a histological examination of the genital organs are given.

The bilateral symmetry of the condition supports the suggestion that the case is one of structural developmental abnormality.

NICHOLS (J. E.). **Meteorological Factors Affecting Fertility in the Sheep.** *Zeit. indukt. Abst.*, Vol. xliii, pp. 313–329. 1926.

Data for flocks of Cheviot and Blackface sheep extending over fourteen years taken in conjunction with meteorological records for the same time indicated differential response of the different breeds to climate. The mean temperature at tupping time has a greater influence on the total yield of lambs than the mean temperature at lambing time, and the latter has a greater influence on Cheviots than on Blackfaces.

Barren ewes, ewes which aborted, and ewes unable to nurse lambs after lambing were grouped together, and the influence of mean temperature on the proportion of this group to the number of ewes put to the ram, is greater for the Blackface than for the Cheviot. There is a suggestion that the mean daily

range of temperature at tupping time has an inverse effect on the total yield of lambs for both breeds. There is also a suggestion that the number of rainy days and the rainfall at lambing time are associated inversely with yield.

NICHOLS (J. E.). **Fertility in Sheep.** *Journ. Min. Agric.*, Vol. xxxiii, No. 3. June, 1926.

The causes of variation in fertility are environmental conditions acting on hereditary differences, the most important being those which produce a high proportion of multiple births and a low proportion of barrenness and abortion.

High lambing percentages can be produced by the practice of flushing, by reason of the increased reproductive activity of the ewes at the beginning of the period of service induced by the nutritional stimulation following the flush.

Barrenness and abortion (apart from pathological conditions) are largely due to environmental factors, but hereditary factors may also play a part in determining their incidence. Barrenness and abortion are most frequent among the younger ewes.

NICHOLS (J. E.). **Fertility in Southdown Sheep.** *Journ. Agric. Sci.*, v, 16, part 3, pp. 365–375.

Data from 26 flocks, involving a total of 5,014 pure-bred Southdown ewes, were available for analysis and discussion. For ewes of all ages the proportion giving birth to twins is closely associated with the total yield of lambs, and while barrenness and abortion may to a certain extent be due to the same causes, it is those factors which cause abortion which also affect the yield by reducing the number of single births, rather than the number of multiple births.

The low fertility of shearling ewes is due to barrenness through reduced or delayed ovulation.

ROBERTS (J. A. F.). **Hereditary Lethal Deformity in Newborn Lambs.** *Journ. Min. Agric.*, Vol. xxxiii, No. 9, pp. 795–801. 1926.

The deformity may be recognised by hydramnios before lambing and extreme difficulty in labour. The lamb, which may be of either sex, is usually still-born and the limbs are perfectly rigid, thus making delivery very difficult and sometimes impossible. The defect may often be mistaken for ordinary still-births, hence the apparent rarity of the condition, but there is reason to believe that it may occur in any breed. The defect is hereditary, and the result of a single recessive Mendelian factor. Thus it is only when both parents carry the factor that the lethal deformity appears in the offspring, and then one in every four lambs is affected. Continued loss from this lethal deformity may be avoided by not breeding from animals known to carry the lethal factor. A short account of lethal factors is added.

ROBERTS (J. A. F.) & WHITE (R. G.). **Fertility and Sex-Ratio in Welsh Mountain Sheep.** *Welsh Journ. Agric.*, Vol. iii, pp. 70–79. 1927.

Welsh Mountain sheep flocks were classified as being kept under mountain, intermediate, or lowland conditions. The difference in fertility between mountain and lowland flocks depends on:—

(*a*) The percentage twinning depending on (1) the condition of ewes at tupping, and (2) date of tupping.

(*b*) The percentage barrenness, depending on (1) the same factors as (*a*); (2) nature of sheep walk and activity of rams; and (3) fœtal atrophy during pregnancy.

(*c*) The percentage of still-births and deaths soon after birth, depending on (1) condition of ewes at lambing time; (2) place of lambing; and (3) care at lambing and after.

(*a*) and (*b*) produce the greatest effects; (*c*) is the most important economically.

No conclusion can be drawn from the differences in sex-ratio between the classes. Fluctuations in sex-ratio do not seem other than the results of chance. The sex-ratio of 1923–1924 did not tend to approximate to that of 1922–1923 in the same period.

ROBERTS (J. A. F.). **A New Method for the Determination of the Fineness of Wool and of the Fleece.** *Journ. Text. Inst.*, Vol. xviii. 1927.

It is suggested that the mean diameter of a sample of wool can best be determined by the calculation of a weight-length ratio, this quantity being estimated as the number of centimetres of fibre that weigh a milligram. This method has advantages from the point of view of the simplicity and convenience of the form in which the information is obtained, and also has advantages of accuracy and convenience in the actual determination.

ROBERTS (J. A. F.). **Kemp in the Fleece of the Welsh Mountain Sheep.** *Journ. Text. Inst.*, v, 17, pp. 1274–1290.

Kemp in Welsh wool, its structure, histology and mode of growth are described and a definition is given.

A method for its quantitative determination is described.

Its importance to the manufacturer is discussed and the correspondence between the biological definition and the technical term is shown.

The relation of kemp to other qualities of the sheep is discussed and by this is suggested a possible line of wool improvement. The importance of the birth coat and its relation to kemp is discussed.

Reference is made to Red Kemp.

ROBERTS (J. A. F.). **Colour Inheritance in Sheep. II. The Piebald Pattern of the Piebald Breed.** *Journ. Genet.*, v, 17, pp. 77–83.

A brief description is given of the Piebald breed of sheep. While there is a considerable range of variation in the extent and nature of the spotting these sheep breed remarkably true for the piebald character.

The result of crosses with other breeds is the production of self-blacks.

A back-cross of the F_1 to white gave six whites and five blacks. A back-cross of the F_1 to piebald gave six piebalds and four blacks.

Piebald sheep differ from other breeds in that they possess a dominant black factor and a recessive pattern factor which restricts the black to certain areas.

SMITH (A. D. BUCHANAN). **Inbreeding in Cattle and Horses.** *Eugen. Rev.*, v, 18, pp. 189–204.

How homozygosity is obtained, measured and estimated is discussed. Sewall Wright's method is believed the best.

Using Sewall Wright's co-efficient it is shown that there has been more inbreeding among Shorthorns than among Clydesdales.

It is suggested that the reason is that one breed has a greater proportion of recessively deleterious characteristics per individual.

It is suggested that the homozygosity of the Clydesdale is due more to careful selection than to inbreeding.

SMITH (A. D. BUCHANAN) with DAVIDSON (H. R.). **Pig Testing and Recording for the Purposes of Advanced Registry.** *Ann. Nat. Pig Breed. Assoc.*

Methods of pig testing and recording in other countries are described.

Judging and recording of utility points in Britain are discussed.

Criticism of present methods is given.

An outline of the proposed scheme is given and suggestions are put forward for its inception.

TAMURA (Y.). **Structural Changes in the Suprarenal Gland of the Mouse during Pregnancy.** *Brit. Journ. Exp. Biol.*, v, 4, pp. 81–92.

The experiments are described and the effects of the operations upon the Suprarenal gland are detailed.

TAMURA (Y.). with CREW (F. A. E.). **On the Effects of Vasectomy and of Epididymo-deferenectomy in the Mouse.** *Proc. Roy. Soc. Edin.*, v, 46, pp. 283–288.

Degeneration of the germinal epithelium of the testis invariably follows the operation of vasoligation or of vasectomy in the mouse, but does not become evident until a considerable period of time has elapsed.

Similar degeneration follows the operation of epididymo-deferentectomy, but after a much shorter interval of time.

This degeneration is caused perhaps by the pressure within the seminiferous tubules exerted by the accumulation of seminal products, or more probably by the action of toxic substances liberated from the disintegrating cell and sperm debris.

(9) DAIRYING.

NATIONAL INSTITUTE FOR RESEARCH IN DAIRYING.

BANKWORTH (H.), MATTICK (A. T. R.), TAYLOR (M. G. D.), and STENHOUSE WILLIAMS (R.). **Relationship between the bacteriological content and the keeping quality of milk.** *Journ. Min. Agric.*, xxxiii, 11, pp. 997–1001. 1927.

For purposes of comparison the figures obtained from 2,476 samples collected during ten clean milk competitions were used. Samples containing no B. coli in 1 c.c. were compared with samples having similar bacterial counts but with B. coli present in any dilution up to 1/1000. It was found that there was a steady fall in the period of sweetness of the milk as the bacteriological count increased, even though B. coli were absent; that the presence of B. coli had a deleterious effect upon the keeping quality of the milk and that within limits it appeared possible that a higher bacteriological count, in the absence of B. coli had a less deleterious effect upon the keeping qualities of milk than a lower count when B. coli was present. It was also found that constancy of temperature was a very important factor in controlling the keeping qualities of milk.

BARTLETT (S.). **Certain aspects of Milking Trials.** *Journ. Brit. Dairy Farmers' Assoc.*, pp. 59–68. 1927.

In this article the author deals with the methods of carrying out certain short period milking trials and discusses the reliability of such tests, suggestions being made for improving the accuracy and eliminating chance and luck to a certain extent. The normal day to day variability of the yields of milk, fat and solids-not-fat, from cows when they are milked and managed under regular farm conditions and free from most of the known causes of variation, are shown by means of coefficients of variation and deductions are drawn therefrom as to the amount of chance involved in short period trials.

The possibilities of inducing abnormal yields and variations for short periods by "nutritional" and "milking" methods and the extent to which this can be done by competitors are considered, and some means are suggested for reducing such practices. The effect of thrice daily milking is discussed.

GOLDING (J.), SOAMES (K. M.) & SILVA (S. S.). **The influence of the Cow's Diet on the fat-Soluble Vitamins of Winter Milk.** *Biochemical Journ.*, xx, 6, pp. 1,306–1,319. 1926.

The inclusion of kale in the winter ration of the cow raises the Vitamin A content but not the vitamin D content of the milk.

The inclusion of cod liver oil in the winter ration of the cow raises the vitamin A and the vitamin D content of the milk.

Previous observation that the administration of high doses of cod liver oil to cows reduces the percentage of fat in their milk is confirmed.

MATTICK (A. T. R.). **Oiliness in Milk.** *Journ. Agric. Sci.*, xvii, Pt. iii, 1927.

Oiliness is due to the catalytic oxidising action of exceedingly minute amounts of copper which are taken up by milk at various points in its handling. Oiliness is not identical with other flavours induced by larger, but still very small, amounts of the metal.

The reaction is, to a large extent, at any rate, dependent on the free access of oxygen in the molecular state.

The reaction is probably limited by rises in temperature which correspond to summer conditions.

Bacteria, although not directly involved in the reaction, act in a retarding capacity either by their own absorption of oxygen or by the production of acidity which carries the system outside the limiting pH or both.

It is possible that the small amounts of metal may exercise an effect on bacterial growth in combination with temperature.

MEANWELL (L. J.). **An investigation into the effect of pasteurisation on the bovine tubercle bacillus in naturally infected milk.** *Journ. Hygiene*, vol. 27, 1, Nov., 1927.

Experiments have been made on the milk of three cows suffering from tuberculosis of the udder. The milk was heated at various temperatures between 138·8° F. and 145° F. for 20 to 30 minutes.

The results of this work show that:—

(1) A temperature of 145° F. for 30 minutes does not invariably kill the tubercle bacilli in naturally infected milk, although in most cases this temperature is effective.

(2) At a temperature of 140° F. for 20 minutes tubercle bacilli are in many cases destroyed, but this combination of time and temperature allows no margin of safety.

The experiments demonstrated that the accuracy of thermometers used to record the temperatures maintained during heating in commercial pasteurisation is one of great importance. It will be found that whilst at 140° F. tubercle bacilli are usually destroyed, at 138·8° F. they survived on no less than ten out of twelve occasions, the exposure lasting 20 minutes in both cases.

WRIGHT (N. C.). **Studies in calcium-caseinogen equilibra, and their Bearing on the Secretion of Calcium in Milk.** *Journ. Agric. Sci.*, xvi, pp. 640–642. 1926.

In dialysis experiments with a collodion membrane separating an internal solution consisting of 4 per cent. caseinogen in 0·02N-sodium hydroxide and external solutions of calcium chloride of varying concentration with and without sodium chloride, added to maintain a constant anionic concentration, a higher concentration of calcium was found within the membrane. The ratio of "internal" to "external" calcium increased as the concentration of the calcium chloride in the outer solution was diminished. It is suggested that the ability of caseinogen to form un-ionised or slightly ionised salts with calcium is mainly responsible for this unequal distribution and also governs the distribution of calcium between blood and secreting cells in the mammary gland.

ANIMAL NUTRITION RESEARCH INSTITUTE, CAMBRIDGE.

SANDERS (H. G.). **On the Accuracy of Three Measurements of Heifers.** *Journ. Agric. Sci.* 16, Pt. 4. 1926.

In an investigation which is being carried out into the effect of the age and size of a heifer at her first calving on her subsequent yield, it is necessary to collect three measurements (shoulder ht., back length, and elbow ht.) of individual heifers at about their calving time. This paper is a preliminary one and attempts to describe the personal error of measurement, and that introduced by growth, the material treated being observations made on six heifers at weekly intervals for five weeks before, and six weeks after calving.

Allowing for growth the standard errors of measurement were found to be 0·636 cms., 0·727 cms., and 0·547 cms. for shoulder ht., back length, and elbow ht. respectively.

SANDERS (H. G.). **The Length of the Interval between Calvings.** *Journ. Agric. Sci.* 17, Pt. 1. 1927.

It is of some importance to know, roughly, what is the best interval to arrange between calvings, in order that the cow's average daily yield over a number of years may be a maximum; an attempt has been made to determine this optimum calving interval from data collected by the Norfolk Milk Recording Society.

The first method of attack was to compare the average daily yields of groups of cows which had series of long and short calving intervals; the second method was to use a set of standardising corrections which had been worked out from nearly 4,000 lactation records, and to calculate the yields to be expected from the "average cow" according as her calving intervals were varied.

In the main, the two methods gave results pointing to the same conclusion, namely, that the optimum interval between calvings lies between twelve and thirteen months; where the interval is only ten months, the average daily yield may be expected to be lowered by 10 per cent., and where the interval is sixteen months, by 2–3 per cent. It is believed that in dairying districts in this country the tendency is towards too frequent calving, but the variation is extremely wide.

SANDERS (H. G.). **The Variations in Milk Yields caused by season of the year, service, age, and dry period, and Elimination. Part I. Season of the Year.** *Journ. Agric. Sci.*, Vol. xvii, Part iii, 1927.

This paper gives the results of a statistical analysis of 3,918 lactations of cows recorded by the Norfolk Milk Recording Society. The best months for a cow to calve for a high lactation yield are the autumn and early winter ones, and the worst the summer; the variation caused by this factor amounts to a little over 10 per cent. As measured by the rate of decline of yield, with cows in milk, the two periods when, on the average, feeding and management are most at fault, are June-July and September-October; the former is most pronounced, and it is suggested that steps should be taken to supplement the pastures much earlier than is usual in practice, *i.e.*, early in June.

ROWETT RESEARCH INSTITUTE.

HUSBAND (A. D.) & GODDEN (W.). **A Note on the Estimation of Chlorine in Milk.** *Biochem. Journ.*, Vol. xxi, No. 1.

This is a technical paper which should be consulted for the suggested improvement in the method. The conclusion arrived at is that in order to determine accurately the chlorine content of milk volumetrically by precipitation of the chlorine as silver chloride, it is essential that the protein be removed before the addition of the silver nitrate.

ORR (J. B.), CRICHTON (A.), CRICHTON (J. A.), HALDANE (E.) & MIDDLETON (W.). **The Effect of Pasteurisation on the Nutritive Value of Milk.** *Scott. Journ. Agric.*, Vol. ix, No. 4.

Feeding experiments were carried out to determine whether any difference could be detected in the health and rate of growth of calves fed on pasteurised milk as compared with calves fed on fresh milk, and also whether the addition of a soluble calcium salt to pasteurised milk would affect its nutritive value.

Four experiments were carried out. The following table shows the nature of the results obtained.

Increase in weight in lbs. of different groups.

	Fresh Milk.	Pasteurised Milk.	Pasteurised Milk plus calcium lactate
50 days milk only	58	51	57
75 days milk plus concentrated ..	135	125	140
Total period, 125 days ..	193	176	197

It is concluded from these results that the process of pasteurisation affects the physiological properties of milk in such a way as to decrease its value for promoting growth and maintaining health in young animals. The evil effects of the pasteurisation can, however, be prevented by certain additions to the pasteurised milk.

In the two tests in which pasteurised milk was compared with fresh milk, the average increase in weight was greater in the calves receiving fresh milk than in those receiving pasteurised milk. In all the tests the rate of growth was greater in the calves receiving the pasteurised milk plus the soluble calcium salt than in those receiving pasteurised milk only.

All the calves receiving either fresh milk or pasteurised milk plus the soluble calcium salt remained in perfect health. Those receiving pasteurised milk were not in such good condition as the others. They had not the same "bloom" of perfect health. It was only in one experiment, however, that gross signs of malnutrition appeared.

MIDLAND AGRICULTURAL AND DAIRY COLLEGE.

CRANFIELD (H. T.), GRIFFITHS (D. G.) & LING (E. R.) **The Composition of Milk.** *Journ. Agric. Sci.*, Vol. xvii. Jan., 1927.

Part I. Variation in the Solids not Fat, Fat and Protein Content of Cow's Milk and their Relationship.

With the object of studying variation in the composition of mixed milk from herds, over 700 samples of mixed milk were taken from 15 herds during 1925–26. Estimations of the percentages of fat, solids not fat and protein were made.

In the case of fat content, 9 herds produced one or more samples below 3 per cent., one herd recording 25 per cent. of samples below this limit. With regard to solids not fat, 12 herds produced milk containing less than 8·5 per cent. on one or more occasions. The highest percentage of deficient samples recorded in one herd being 40.

The analytical data obtained were subjected to statistical analysis and the results obtained indicate positive correlations between fat and solids not fat, and protein and solids not fat.

With regard to the fat and solids not fat correlation, the fat percentage appears to fall with the solids not fat percentage to about the region of 8·8 per cent. solids not fat. Below this point the fat percentage shows a tendency to rise—in fact many milks showing very low solids not fat content contained a comparatively high percentage of fat.

With regard to the protein and solids not fat correlation, the protein content falls rapidly with the solids not fat, but the protein fall appears to be arrested in the region of low solids not fat figures.

With regard to the effect of season, the ratio of solids not fat to protein appears to be low in summer and high in winter, indicating that deficiency in solids not fat is due to lactose in the summer and proteins in the winter.

Part II.—Variation in the Percentage of mineral constituents in Cow's Milk, and their Relationship with the Solids not Fat and Protein Content.

This paper deals with the data obtained by determining the percentages of total ash, soluble ash, insoluble ash, lime and phosphoric acid in the samples of mixed milk referred to in the previous paper. Statistical analysis shows that the total ash content falls with the percentage of solids not fat until low values are reached when the ash content appears to rise. Soluble ash falls and insoluble ash rises with decreasing percentages of solids not fat. Lime and phosphoric acid both fall with the solids not fat content.

With regard to seasonal influence, total ash and soluble ash reached a maximum in summer, but give low average figures in the winter months, whilst the insoluble ash appears to fall in spring and rise in the autumn. The phosphoric acid content shows little change during the year, but the percentage of lime falls in the spring and summer, rising again in the autumn.

UNIVERSITY COLLEGE OF WALES, ABERYSTWYTH.

Davies (R. O.) & Provan (A. L.). **The Relationship between Various Factors and the Ash Constituents of Milk.** *Welsh Journ. Agric.*, Vol. iii. 1927.

A close relationship existed between the concentration of calcium and yield of milk during the period of investigation. The chlorine content varied within wide limits. The concentration of potash depended upon the proper functioning of the milk glands, and on the season. The phosphorus concentration depended on the proper functioning of the glands, and on the stage of lactation.

The composition of milk, including the concentration of ash constituents, was not affected by feeding for two months on a low protein winter ration. At the commencement of grazing in May a temporary increase in the concentration of phosphorus and protein occurred in the milk from cows on both a balanced and a low protein ration. This increase was greater in the case of the milk from the low protein group.

Thomas (S. B.) **A Study of Some of the Factors governing Clean Milk Production.** *Welsh Journ. Agric.*, Vol. iii. 1927.

A summary of the bacteriological results of the clean milk competitions organised in Brecon and Radnor, Carmarthen, Montgomery and Pembroke during 1926 is given.

Of 306 samples submitted by forty-one competitors distributed over these five counties, 76 per cent. attained Grade "A" standards, and 62 per cent. certified standards.

These results prove that milk of a very high standard of cleanliness can be produced under normal conditions existing on the majority of Welsh farms, providing cleanliness is ensured in the byre and dairy.

A comparison is made with the results of the examination of surprise retail samples from over a hundred farms in Mid and West Wales, during the summer months. Over 40 per cent. of these samples attained Grade "A" standards.

The average keeping quality of the milk examined during the first series of samples (January—February) was 3·6 days; while the average for the last series (March—April) was 4·4 days. These figures show the improvement effected during the course of the competition.

A comparison of the most general methods of procedure in the byre and dairy, with the bacteriological results, show that the four chief factors in the production of clean milk are as follows:—(*a*) Sterilisation of utensils by steam or scalding water: (*b*) Attention to details during milking: (*c*) Cooling to as low a temperature as possible, *immediately* after milking: (*d*) The personal factor.

EDINBURGH AND EAST OF SCOTLAND COLLEGE OF AGRICULTURE.

Cunningham (A.) & Jenkins (H.). **Studies on** *Bac. Amylobacter* **A. M. et Bredemann.** *Journ. Agric. Sci.*, xvii. 109–117. 1927.

A coccus has been obtained from pure cultures of *Bac. Amylobacter*. It is Gram positive, is a facultative anærobe and is destroyed at 80° C. in ten minutes.

That the coccus is a growth form of the bacillus and not a contaminant is proved by the following facts:—

(1) Microscopic examination of anærobic cultures of the bacillus has invariably failed to reveal the presence of typical cocci.

(2) When sub-cultures from the bacillus are incubated under partially ærobic conditions the coccus is frequently obtained. Media inoculated from the same stock cultures and incubated ærobically invariably produce no growth although the coccus grows vigorously under these conditions.

(3) The coccus can be obtained from cultures of the bacillus which have been heated at 80°C. for ten minutes.

(4) All cultural experiments have been carefully controlled. Uninoculated media incubated along with the cultures of the bacillus as well as ærobic cultures from heated material yielded no growth.

(5) Cocci have been obtained from all six strains of the bacillus studied.

(6) The cocci isolated are uniform in cultural characteristics.

WEST OF SCOTLAND AGRICULTURAL COLLEGE.

M'Candlish (A. C.) & Kay (R. R.). **Dried Beet Pulp.** *Scottish Farmer*, Vol. xxxiv. No. 1761, p. 1290 and Vol. xxxiv. No. 1762, p. 1322. 16th and 23rd October, 1926.

This is a report of a preliminary trial in which the influence of dried beet pulp on the composition of milk was studied. Eight cows were used in a trial of 40 days. The allowances of hay, straw, silage, and concentrates were kept constant throughout, while 5 lbs. of dried beet pulp were soaked and fed in the first period and 25 lbs. of swedes were given in the second.

The trial was not long enough to be used in comparing the nutritive values of dried beet pulp and roots, but it would show if either feed had any detrimental effect on the composition of the milk. It was found that the feeding of the dried beet pulp had no detrimental effect on the composition of the milk, in fact the percentages of fat and other solids were relatively constant.

M'Candlish (A. C.) & Kay (R. R.). **Swedes vs. Silage and Swedes for Milk Production.** *Scottish Journ. Agric.*, Vol. 10, No. 2, p. 226. Apr., 1927.

A silage composed of oats, peas, beans and vetches was used. Ten cows were used in a trial lasting 90 days. In the first and third periods an allowance

of 12 lbs. of silage and 20 lbs. swedes daily was given, while in the second period, the succulent portion of the ration consisted of 40 lbs. swedes. Hay and straw and a suitable grain mixture were also fed.

Both rations gave satisfactory results and 12 cwts. of the silage was found to be equivalent in feeding value to 1 ton of swedes. Consequently if a crop of 20 tons of swedes per acre can be obtained then 12 tons of silage per acre must be fed out of the silo to get equal returns in milk production.

M'Candlish (A. C.). **Water for Dairy Cows.** *Yorks, Milk Rec. Soc. Ann. Rpt.*, p. 37. June, 1927.

A general review of the water supply problem is given, while it is shown from experimental work that cows in winter consumed 5½ gallons of drinking water per gallon of milk produced. This does not include the water obtained from the succulent feeds consumed.

M'Candlish (A. C.). **Turnips or no Turnips?** *Farming News*, No. 640, p. 6. Sept., 1927.

Eight cows were used for three periods of 20 days each with the accompanying transition periods. During the first and third periods a roughage allowance of 16 lbs. of hay and 40 lbs. of swedes was given, while in the second period the animals received 20 lbs. of hay and no swedes. A suitable concentrate mixture was fed throughout.

The average daily production per cow was 31·4 lbs. milk and 1·16 lbs. butter fat when roots were fed and 30·1 lbs. milk and 1·11 lbs. fat when no roots were given. The feed cost per gallon of milk was 5·2d. when roots were fed, and 5·7d. when no roots were given—a difference of ½d. per gallon in favour of the roots.

(10) ANIMAL DISEASES.

INSTITUTE FOR RESEARCH IN ANIMAL PATHOLOGY, ROYAL VETERINARY COLLEGE.

McEwen (A. D.). **Quarter Evil and Braxy—Studies Regarding Immunity.** *Journ. Comp. Path. and Thera.*, Vol. xxxix, No. 4, pp. 253–282. Dec., 1926.

The author's paper contains a new medium for the cultivation of *B. chauvei* and *V. septique* and other anærobes in broth. An advantage of the medium is that it is free from tissue debris. Luxuriant growth was obtained without the use of an anærobic jar. Ten strains of *B. chauvei* and 16 strains of *V. septique* were studied. Agglutination tests applied to nine of the *B. chauvei* strains showed that they all belonged to a similar type. Non-toxic filtrates of this organism were found capable of producing a considerable degree of immunity, but better results were obtained with a vaccine containing the bacillary bodies of *B. chauvei* sterilised by formalin. Agglutination tests showed that ten of the strains of *V. septique* belonged to one type, four to another type, and the two remaining strains differed from the others. Non-toxic filtrates and cultures of *V. septique* failed to immunise, but toxic cultures in large doses produced a considerable degree of immunity. Filtrates were found to be of less value than *B. chauvei* filtrates. An immunity was readily established by the use of vaccine containing the bacillary bodies of *V. septique* or their spores sterilised by the action of formalin. The advantages of this vaccine are the high degree of immunity produced, its complete safety, the smallness of the dose, ·5 to 1 c.c., and the fact that only one inoculation is necessary.

Sheather (A. L.) **Experiments in the treatment of Parasitic Gastritis in Lambs.** *Journ. Comp. Path. and Thera.*, Vol. xl, Part 1, pp. 37–59. Mar., 1927.

The author's experiments, which extended over two years, were directed to discovering a better method of destroying parasitic worms in the fourth stomach of ruminants, and especially the *Ostertagia circumcincta*, which is the principal cause of parasitic gastritis in sheep in England. The animals used in the experiment were lambs or young sheep under a year old, derived from flocks in which other animals had died from infestation with parasites.

Before treatment the fæces of each lamb were examined by the sugar flotation method in order to ascertain the degree of infestation, and the same method was employed to ascertain the results of treatment. Eventually the animals were killed and the stomach and intestines were examined for worms.

The experiments confirmed the conclusions arrived at by Veglia with regard to the destructive effect of sodium arsenite and copper sulphate for *Haemonchus contortus*. The same combination of drugs was quite ineffective against the other species encountered:—*Ostertagia circumcincta, trifurcata, Trichostrongylus extenuatus, instabilis, and vitrinus.*

The drugs employed included bleaching powder, either alone or in conjunction with hydrochloric acid or boracic acid, sodium bisulphite with hydrochloric acid; carbon tetrachloride, mixed with liquid paraffin; iodine in solution in liquid paraffin, ether, and oleic acid; pure derris root powder; copper oleate, with or without sodium oleate, oil of chenopodium, thymol dissolved in turpentine, and lime and sulphur wash.

Sheather (A. L.). **The treatment of Johne's Disease by the Intravenous Injection of Formalin.** *Journ. Comp. Path. & Thera.*, Vol. 40, p. 224.

The experiments were designed to test the alleged successful treatment of Johne's disease in cattle by means of intravenous injections of formalin. In three natural cases 16, 25 and 34 injections of 250–500 c.c. 0·5 per cent.

formalin solution were given at intervals of a few days. In one case this treatment was alternated with injections of 0·2 per cent. biniodide of mercury. In a fourth case four injections each of 500 c.c. of 0·75 per cent. of formalin were given.

Formalin by the intravenous route appears to be remarkably effectual in checking the diarrhoea, but there was no evidence of the disease being cured.

INSTITUTE OF AGRICULTURAL PARASITOLOGY, LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE.

CAMERON (T. W. M.) **On the Morphology of the Free-Living Larvæ of *Chabertia ovina*.** *Journ. Helm.*, iv, 185–190.

Chabertia ovina is one of the common parasites of the large intestine of sheep and although it has been well known for many years, little was known about its life history. This paper is a study of the morphology of the larval stages which occur outside the body. The eggs, passed in the droppings, hatched out in one to three days; the resulting larva grew and moulted within two days, resulting in a form morphologically almost identical with the first stage; two days later the larva moulted a second time but remained within its case cuticle. This is the infective stage, which is formed in five to seven days after the egg is passed in the droppings. Details of the morphology of these three stages are given, by which they may be recognised and the method of feeding of the free larvæ is described.

CAMERON (T. W. M.). **Some modern biological conceptions of Hydatid.** *Proc. Roy. Soc. Med.*, xx, 272–283.

The Hydatid cyst is the larval stage of several species of minute tapeworms, which as adults, live in the small intestine of dogs, cats and related carnivores. This cyst is a very serious parasite, not only to domestic mammals, but to man. This paper is an account of the modern conceptions of the biology of the cyst in various hosts. The histology of the cyst is described in detail and a full account is given of its development. The production of daughter cysts, as a protective mechanism, is discussed. These are normally produced inside the mother cyst, and the older belief that external daughter cysts are also produced is believed to be no longer tenable. The various forms of abnormal cysts in the sheep, ox, pig, horse and man are described and the pathological reactions of each are discussed. An explanation of the cancerous form found on man on the basis of an abnormal host reaction is offered.

CAMERON (T. W. M.) **The Helminth Parasites of Animals and Human Disease.** *Proc. Roy. Soc. Med.*, xx, 547–556.

This paper is essentially an annotated list of the parasites of animals which also occur in man. An account of the epidemiology of Hydatid disease is given, and other helminths which accidently occur in man as larval forms are briefly considered. Trichinosis in the pig and in man and other accidental adult forms are discussed. The subjects of biological strains and reservoir hosts are also considered: and the methods by which man originally became infected with parasites, are suggested, from the point of view of the evolutionary hypothesis. The article concludes with a list of parasites of man, and the animals in which these parasites also occur.

CAMERON (T. W. M.). **Studies on Three New Genera and Some Little Known Species of the Nematode Family *Protostrongylidæ* Leiper.** *Journ. Helm*, Vol. i–xxiv, 14 figs.

This is a detailed morphological study of those lungworms of stock and allied forms which used to be included in the genus *Synthetocaulus*.

Protostrongylus rufescens, the type of the family, is a well-known sheep parasite and is here described in detail, and the other members of this genus are briefly compared with it. A new genus, *Muellerius* (called after Mueller, who originally described it), is made for the commonest British lungworm, from sheep, *M. capillaris*. This form is also described in detail and the larva is figured. A new genus is also made for the lungworm from the cat, *Aelurostrongylus* (Cat-strongyle), and a detailed description is given. Other parasites described include a new species from the lungs of the British Pole Cat, and a peculiar form from the frontal sinuses of the British Weasel.

Cameron (T. W. M.). **Observations on the Life History of** *Aelurostrongylus abstrusus* (Railliet), **the Lungworm of the Cat.** *Journ. Helm.*, Vol. 5, No. 2.

The lung worm of the cat deposits eggs in the lung tissue, where they develop into larvæ. These larvæ leave the lung tissue, migrate up the trachea and are swallowed, passing to the exterior in the fæces. There they are ingested by mice, and in these animals they develop into an infective encysted larva. On such a mouse being eaten by a cat, the larvæ escape from the cysts, migrate to the lungs and become sexually mature. The larvæ of this species had previously been mistaken for the larvæ of the Stomach-worm from which, however, they are quite distinct. Larvæ as passed in the stool are not infective for other cats.

Cameron (T. W. M.). **Observations on the Life History of** *Ollulanus tricuspis* **Leuck., the Stomach Worm of a Cat.** *Journ. Helm.*, Vol. v, No. 2.

The adult parasites live in the mucosa of the stomach of the cat. Embryos are developed in the uterus of the female and they moult at least once before being discharged into the stomach. They are passed to the exterior in the vomit—no larvæ could ever be found in the intestine. On being swallowed by another cat, the larvæ develop to maturity directly in the stomach. The life history presents the usual stages characteristic of other nematodes, but owing to the moults *in utero*, the free life may be remarkably short.

Cameron (T. W. M.). **On** *Microstrongylus genettæ* **gen. and sp. nov., a Trichostrongyle Parasite of** *Genetta senegalensis*. *Journ. Helm.* Vol. v, No. 2.

This is a morphological description of a minute threadworm found in the genette. It is of interest because this is only the second species of this group, from carnivores, of which we have any adequate account. A key to the various genera in this family is appended.

Cameron (T. W. M.). **On** *Arthrostoma felineum*, **gen. et sp. nov., a Parasite of Cats.** *Journ. Helm.*, Vol. v, No. 3.

This is a morphological description of a small species of hookworm recovered originally from the small intestine of a Golden Cat and experimentally transferred to the domestic cat. It differs from most existing species by the fact that the mouth capsule is composed of a set of eight articulating plates.

Cameron (T. W. M.). **On the Parasitic Development of** *Monodontus trigonocephalus*, **the Sheep Hookworm.** *Journ. Helm.* Vol. v, No. 3.

After a preliminary discussion on the "ideal" life cycle of hookworms in general, the parasitic development of the sheep hookworm, a common parasite in British sheep, is described. The infective forms of this parasite are able

to climb from almost solid fæces, but unlike the human and canine forms, they cannot penetrate the skin and infection appears to be by ingestion. In the intestine, the young parasite acquires a temporary spherical mouth capsule which is described in detail. After feeding on the mucosa and growing considerably in size, this mouth capsule is exchanged for the adult type and the parasites become sexually mature. This development is described and illustrated. Like the human species, this hookworm has four larval stages, each separated by a moult. Two of these stages are free feeding in fæces, one is transitionary and infective and the fourth is purely parasitic.

GOODEY (T.). **Some Stages in the Development of *Œsophagostomum dentatum* from the Pig.** *Journ. Helm.*, Vol. iv, Nos. 4–5.

Detailed studies of the morphology of the adults of *Œsophagostomum dentatum*, parasitic in the cæcum and large intestine of the pig, and of the free larval development were published by the writer in this Journal three years ago. The present paper deals with the morphology of the 3rd and 4th larval stages obtained by the experimental infection of pigs, thus completing our knowledge of the life-history of the worm.

The smallest 3rd stage larvæ found were of about the same size as the infective larvæ but some growth and change had taken place in the buccal region and in the cervical glands. Transitional stages showing the ecdysis separating this stage from the next were not found. Numerous 4th stage larvæ of both sexes were studied in detail. The head end is provided with a provisional buccal capsule shaped like a short hollow cylinder and similar in essentials to that which has been described by other investigators in *Œsophagostomum radiatum* and *O. columbianum*. Well advanced 4th stage larvæ revealing the developing adult head characters are described and figured.

GOODEY (T.). ***Cylindrogaster coprophaga* gen. et sp. nov. A Nematode found in a Culture of Fæces from a Wild Brown Rat.** *Journ. Helm.*, Vol. v, No. 1.

The study of Nematodes occurring in fæces is of importance in view of the possibility of their being confused with free larvæ of parasitic forms. Some worms cropping up in a culture of fæces of the brown rat were found to possess certain anatomical features which marked them off as distinct and worthy of being placed in a new genus.

Adults of both sexes are about 1 mm. in length by ·03 mm. in width. The most outstanding characteristics in both sexes are the possession of long pharyngeal rods and a muscular first œsophageal bulb shaped like a cylinder with rounded ends; hence the name *Cylindrogaster*. The arrangement of the male caudal papillæ proved of great interest, for it was found to be practically the same as that in two widely separated nematode genera, *Diplogaster* and *Odontopharynx*.

It was found that the worms grew readily in cultures made from the droppings of guinea-pigs and rabbits as well as from rats. The systematic position of the genus is also discussed.

LEIPER (R. T.). **On the Round Worm Genera *Protostrongylus* and *Angiostrongylus* of Kamensky, 1905.** *Journ. Helm*, Vol. iv, No. 4–5.

Attention is drawn to an important, but overlooked, paper published in Russian by Kamensky in 1905, dealing with the systematic position and differential diagnosis of the lung worms causing husk in sheep, hares, &c. In this communication Kamensky created two genera, *Protostrongylus* and *Angiostrongylus*. *Protostrongylus*, in favour of which the more common name *Synthetocaulus* must now be suppressed, and *Metastrongylus* were

united by Kamensky into one sub-family *Protostrongylinæ*. The genus *Angiostrongylus* was created by Kamensky to include the round worms recorded from the heart and pulmonary artery of the dog, and this name must take the place of the later generic name *Hæmostrongylus*, Railliet and Henry, 1907.

Lewis (E. A.). **Helminths collected from Horses in the Aberystwyth Area.** *Journ. Helm.*, Vol. v, No. 4–5.

As the records dealing with the occurrence of internal parasites of horses in Wales are somewhat scanty, the writer carefully examined a number of horses from the region of Aberystwyth. 24 species are identified, 21 being species of Strongyles, one a species of Ascarid, one of Oxyurid and one Tapeworm. All are previously known species but 15 are recorded for the first time from Wales.

Lewis (E. Aneurin). **A Survey of Welsh Helminthology.** *Journ. Helm.*, Vol. 5, No. 3.

Helminthological investigation in Wales commenced in 1874 when Cobbold found that the "disastrous epizooty" in Welsh ponies was caused by tapeworms and strongyles.

An unfruitful period elapsed until 1917, when Walton resumed helminthological work, and dealt with problems relating to "Liver-rot."

An intensive survey of helminths of sheep, cattle and pigs was commenced at Aberystwyth in 1923 by Morgan.

Lewis continued this survey and made further records from horses, and wild birds; and studied the lung-worms of pigs, and the distribution of "Gapes" by starlings.

Other Welsh helminthologists were Jenkins (1923), Montgomerie (1925–1926), Jones (1926), John (1926), Bissett (1925), and Wright (1927).

Morgan (D. O.). **Studies on the Family Opisthorchiidæ Braun, 1901, with a description of a New Species of *Opisthorchis* from a Sarus Crane (*Antigone antigone*).** *Journ. Helm.* Vol. v, No. 4.

A new species of *Opisthorchis dentriticus* is described and a study of this species, together with other recently described species, necessitates a revision of the genera of the Family Opisthorchiidæ. The author considers that *Clonorchus* and *Notaulus* are no longer tenable and the species included in the genera are placed in *Opisthorchis*. Notes are added on all the genera of the Family and a key of these is also appended. The grouping of the genera into sub-families is not possible in the present state of our knowledge of this group.

Morgan (D. O.). **A New Species of the Nematode Genus *Paraspidodera* from the Wild Pig.** *Journ. Helm.*, Vol. v, No. 2.

A description of a new species, *Paraspidodera sellsi*, from a wild pig in Uganda, is given together with a discussion on its systematic position.

Oldham (J. N.). **On the Larval Stage of *Pedicia rivosa*, L.** *Proc. Roy. Physical Soc.*, Vol. xxi, Part 2.

Pedicia rivosa, L. (Limnobiidæ, Diptera) is a member of a small genus whose larvæ are strictly aquatic. Records of its distribution in Britain are given.

The paper deals principally with the full-grown larva. A description of the external morphology and internal anatomy of this stage is detailed,

special attention being given to the respiratory system; A particular feature of the larva is its possession of four anal gills which, although co-existing with two posterior spiracles, are concluded—from respiration experiments which were carried out—to be accessory in function, merely assisting in the respiratory process, which cannot be accomplished by these organs alone.

Brief mention is made of the pupa and habits of the adult.

Observations made on larvæ in captivity and also in their natural environment are given with reference to their occurrence, mode of life, and food habits.

A Protozoan (Gregarine) parasite was encountered in the larval alimentary canal.

A short comparison of the species with the larvæ of other Diptera is included.

Ortlepp (R. J.). **On the Identity of *Physaloptera caucasica* v. Linstow, 1906, and *Physaloptera mordens* Leiper, 1908.** *Journ. Helm.*, Vol. v, No. 4–5, pp. 199–202. (3 text figs.)

It has been believed hitherto that two species of *Physaloptera* were human parasites, viz. *P. caucasica* and *P. mordens*. A re-examination by Schulz of v. Linstow's type material showed that it differed considerably from the original description and was closely related to *P. mordens*. At the request of Professor Leiper, the writer re-examined the type material of *P. mordens* and concludes that the two species are identical. In consequence, the name ***P. mordens*** becomes a synonym of ***P. caucasica***.

Triffitt (M. J.) & Oldham (J. N.). **Observations on the Morphology and Bionomics of *Rhabditis pearsoni* Leuck. occurring on Dung Beetles.** *Journ. Helm.* 5 (i), 33–46, 7 fig. 1927.

Several coprophagous beetles encountered in Warwickshire, England, were found bearing the nematode, *Rhabditis pearsoni* Leuck. encysted upon the exoskeleton. Using sterilised sheep fæces, cultures were set up and the complete life-cycle of the worm studied. When infested beetles encounter fresh dung, conditions necessary for exocystation are attained and the escaping larvæ assume an active life, feed, grow and become adult. Following fertilisation, segmented eggs are passed giving rise to free-living larvæ which grow to pre-encystment stage. Further development is apparently unable to take place unless some beetle is present on which encystation can occur.

Morphological descriptions of the various stages are detailed; the adult female worm is noteworthy in possessing, near the vulva, a pair of curious sac-like bodies, containing masses of spermatozoa, and apparently serving as receptacula seminis.

Several species of coprophagous coleoptera were artificially infested, cysts commonly occurring on the tibiæ, tarsi, elytra, thorax and mouth-parts, often in hundreds. Encystation failed to occur on inanimate objects or dead beetles, but was observed on some larval insects and on certain introduced *Coccinellidæ* normally not dung-inhabitants. Further investigations on the bionomics of the nematode are contemplated.

Triffitt (M. J.). **Observations on the Oöcysts of Coccidia found in the Fæces of Carnivores.** *Protozoology*, No. 3.

This paper deals with three cases in which oöcysts belonging to the genus *Isospora* were found in the faeces of undomesticated carnivores, namely a fox, a lynx and an eyot-cat. The first of these was obtained from a fox farm in Canada, and the two latter from the Zoological Society of London. The morphology of the oöcysts is described is detail and the probable affinities

of the parasites are discussed. It is concluded that they represent *Isospora bigemina, Isospora felis* and *Isospora rivolta* respectively. Unfortunately no other stages of the life-cycles were obtainable.

TRIFFITT (M. J.). **Some Cephaline Gregarines parasitic in British Myriopods.** *Protozoology*, No. 3.

Seven species of cephaline Gregarines are described and figured. Of these, two are new to science, namely, *Amphoroides cerci*, n.sp., parasitic in *Polydesmus complanatus*, and *Actinocephalus blaniuli*, n.sp., parasitic in *Blaniulus guttulatus*. Three forms described from *Tachypodoiulus niger* are also considered by the author to represent new species but are left unnamed pending further investigation into the morphological characters of other stages of their life-cycles. The trophozoite of *Cnemidospora lutea* Schneider 1882, hitherto unknown, is also described.

TRIFFITT (M. J.). **Note on the Occurrence of a Sarcocyst, parasitic in a Wallaby.** *Protozoology*, No. 3.

A Sarcocyst discovered in the muscular layers of the intestine of a Wallaby is described. The structure and position of the parasite are commented on and attention is drawn to the fact that this is, in all probability, the first authentic record of a Sarcocyst parasitic in a Marsupial, as Darling's case, *S. darlingi* Brumpt, 1913, is now generally considered to belong to the genus *Globidium*.

INSTITUTE OF ANIMAL PATHOLOGY, CAMBRIDGE.

BOSWORTH (T. J.). **Actinomycosis in Sheep.** *Vet. Record*, Vol. vii, No. 40, pp. 844–5, 1927.

This article is a description of two cases of actinomycosis in the sheep, in which animal the disease appears to be somewhat rare. In both instances the jaw bones and glands of the head were affected and in addition extensive lesions of the lungs and bronchial gland were present in one of the animals.

There was evidence to show that the infection gained access through the alveoli of the molar teeth. The causal organism was the Actinobacillus which was obtained from one of the cases in pure culture. It proved to be of low virulence for experimental animals.

CORBET (A. S.) & JAMESON (A. P.). **The Toxicity of Phenylarsenic acids for** *Balantidium Coli* **Malm. in cultures, in relation to their chemical Constitution.** *Biochem. Journ.*, Vol. xxi, No. 4, 1927.

In this paper an improved technique is given for obtaining results of toxicity tests on organisms *in vitro*. The following results were obtained which conform very closely with the generalisations of *in vivo* work:—

(*a*) The position of the amino group has a very definite effect on the toxicity of the aminophenyl arsenates which are highly toxic.

(*b*) The substitution of a hydroxy-group for the amino-group does not greatly alter the toxicity.

(*c*) The substitution in the amino-group of p-aminophenyl arsenate, in the case of tryparsamide, has lowered its toxicity considerably.

(*d*) A marked decrease in parasiticidal effect was observed in every case when an acetylamino group was added in a position *meta* to the arsenic grouping.

CORNELL (R. L.). **A Case of Streptococcic Endocarditis in a Pig.** *Vet. Record*, Vol. vii, No. 14, 1927.

A case of endocarditis in a pig due to a streptococcus is described together with the biological characters of a streptococcus isolated from the spleen of the same animal. The lesions in the heart were confined to the mitral valve and the aortic cusps. A small crater-like ulcer was present in the wall of the aorta. The vegetations were rather more dense than those encountered in the endocarditis of swine erysipelas, and slight calcification was noted.

Histologically the affected valves conformed to the usual picture met with in endocarditis lesions; short chains of streptococci could be demonstrated in preparations stained by Gram's method. A non-hæmolytic streptoccccus was obtained in pure culture from the spleen.

ROWETT RESEARCH INSTITUTE.

MCGOWAN (J. P.). **Pernicious Anaemia, Leucaemia and Aplastic Anaemia.** Pub. H. K. Lewis & Co., Ltd., London.

A monograph dealing with an investigation from the comparative Pathology and Embryological Point of view into Anaemia and Leucaemia.

(SCOTTISH) ANIMAL DISEASES RESEARCH ASSOCIATION.

Annual Report of the Research Institute for the Year 1925.

Records the move of the Association's laboratories from Glasgow to the new Institute at Edinburgh.

Braxy.—Records the results of braxy inoculations during the previous season. 35,000 to 40,000 doses of vaccine are issued by the laboratory each year for the inoculation of the lambs in the first autumn of their life. The vaccine is considered by the users to give good results.

Lamb Dysentery.—Records the work which has been carried out to ascertain the method in which the disease is acquired. Points out the difficulty that is found in estimating the importance of bacteria which were recovered from the lesions of sick animals. Emphasises that all the evidence indicates that the infection occurs after birth and that it is obtained directly or indirectly from the soil, the latter having been contaminated by the fæces of prior cases. Trials carried out with vaccines and serums prepared from Vibrion septique, Bacillus welchii and Bacillus coli gave inconclusive results.

Louping Ill.—Records the difficulty in setting up the disease artificially. Discusses briefly the theories which can be entertained as to the etiology of the disease.

Grass Sickness in Horses.—Records the work which was carried out at a field laboratory set up in the disease area. As in the case of some of the other widespread enzootic diseases in Scotland attempts to set up the disease under artificial conditions have resulted in failure. Investigations of the disease are in progress.

Vaccination against Tuberculosis.—The calves of a certain number of herds are being vaccinated with Calmette and Guerins B.C.G. vaccine. The experiments have not been undertaken for a sufficient time to estimate the value of the method.

Miscellaneous Work.—Records miscellaneous work in connection with mammitis and abortion in cattle, the preparation of autogenous vaccine, etc.

Pool (W. A.). **"Grass Disease" in Horses.** *Vet. Record*, viii, 23.

The diseases of horses comparable to some extent with equine "Grass Disease" are described and the relevant literature is reviewed at some length. The diseases concerned are epizootic cerebro-spinal meningitis, American "Forage Poisoning" and "Borna Disease."

The bacteriology of these various conditions is reviewed. It is shown that there is very little evidence for the incrimination of certain cocci which are almost constantly present at post-mortem examination of horses affected with these and some other conditions. A brief account is given of the history of B. botulinus investigations from the time the organism was discovered to date.

The salient features of the epizootiology of "Grass Disease" are described and comparison is made with the above mentioned conditions. This shows that the claims of certain authors that "Grass Disease" is botulism cannot be admitted, the symptoms of the two diseases differing considerably in important respects.

The most probable causes of "Grass Disease" are discussed and the directions in which future work should proceed, are emphasised.

ANIMAL BREEDING RESEARCH DEPARTMENT, UNIVERSITY OF EDINBURGH.

Crew (F. A. E.) with Sewell (L.). **Dermoid Cyst in a Cat.** *Vet. Journ.*, v, 82, pp, 509–511.

Results of microscopic examination are given and differences between this case and more common ones are shown.

Theories regarding the origin of such tumours are briefly referred to.

UNIVERSITY OF LIVERPOOL.

Downham (K. D.). **Tuberculosis.** *Ann. Rep. Vet. Adviser, Liverpool University*, 1926–27.

Records that experimental work against tuberculosis in calves has been started with Calmette and Guerin's vaccine. The herds that have been tuberculin tested show that a very high percentage of cattle are affected with tuberculosis (85 per cent. in one herd). The disease is seen to be very much in need of control.

Downham (K. D.) **Mastitis.** *Ann. Rep. Vet. Adviser, Liverpool University*, 1926–27.

Records that there has been an increase in the number of cases of mastitis. In addition to streptococci, staphylococci and Bacillus coli, the Bacillus pyogenes has been found as the causal organism in certain cases.

Downham (K. D.). **Sheep Diseases.** *Ann. Rep. Vet. Adviser, Liverpool University*, 1926–27.

Preliminary observations started on a clinical condition of ewes at lambing time shows that in certain areas there is a loss of about 4 per cent. annually from this affection. It is too early to form any definite conclusion as to the cause at present, but it appears likely that it may be found to be a toxaemia resulting from an interference of the nervous mechanism of alimentation.

UNIVERSITY COLLEGE OF NORTH WALES, BANGOR.

MONTGOMERIE (R. F.). **Some Miscellaneous Observations on the Anthelmintic Value of Carbon Tetrachloride in Sheep.** *Vet. Journ.*, vol. lxxxii, pp. 583–591. Dec., 1926.

The experiments and observations recorded were conducted subsequent to an investigation of the toxicity of pure carbon tetrachloride for sheep and of the anthelmintic action of the drug towards the common liver fluke. (*Journ. Comp. Path. and Thera.*, vol. xxxix, pp. 113–131). Single experiments indicated (1) that simultaneous administration of magnesium sulphate (the fill of a No. 12 hard gelatine capsule of the dry salt) did not interfere with the efficiency of dosage with 1 c.c. of carbon tetrachloride in the treatment of liver rot; (2) that 5 c.c. of carbon tetrachloride administered with magnesium sulphate, was efficient against a mixed (liver fluke and alimentary nematode) infestation, a small proportion of the nematodes only escaping.

Further observations were made with subjects drawn from a flock, composed chiefly of young Welsh Mountain Sheep, seriously infested with alimentary nematodes. *Hæmonchus contortus* formed the major part of the infestation while *T. ovis* and *O. venulosum* were also present.

Field trials, 14 subjects, showed that dosage with 5 c.c. of carbon tetrachloride was an efficient mode of treatment; that the simultaneous administration of magnesium sulphate did not markedly influence this efficiency, and that this dose might be used in the treatment of sheep of the maximum weights met in the Welsh Mountain breed. The treatment of the general flock, 372 sheep, bore out these findings.

MONTGOMERIE (R. F.). **Male Fern in Liver Rot of Sheep—A comparison of the toxicity and efficiency of various brands.** *Journ. Comp. Path. & Thera.*, Vol. xxxix. Dec., 1926.

Samples of liquid extract of male fern B.P. were obtained from four drug houses. These commercial brands vary little, if any, in their toxicity and therapeutic efficiency in the treatment of liver rot of sheep.

Observations on the toxicity of extract of some age suggested that freshly prepared male fern is more toxic than material of some age. Further observations on this point were contemplated.

MONTGOMERIE (R. F.). **The Control of Liver Rot of Sheep.** *Journ. Min. Agric.*, Vol. xxxiv, No. 5, pp. 433–443, Aug., 1927.

A review of recent research work relating to Liver Rot and a discussion of the application of the results obtained. Control measures are recommended, particularly copper sulphate dressings to destroy the intermediate host snails and dosage of sheep with carbon tetrachloride to kill infesting flukes. The value of periodic dosage of flocks is emphasised and its advantages over the treatment of individual sheep as they become clinical cases of liver rot pointed out.

WALTON (C. L.) and REES WRIGHT (W.). **Hydrogen-ion concentration and the Distribution of *Limnæa truncatula* and *L. peregra*. with a note bearing on Mosquitoes.** *Parasit.*, xviii, 4, pp. 363–67. Dec., 1926.

This paper amplifies and extends the observations of Atkins and Lebour (*Proc. R. Dub. Soc.*, xvii, 1924) and records observations from 69 stations in N. Wales, chiefly readings made in the field. The total range of pH observed was from 5·6 to 8·8 with a maximum number of readings 7·4–7·6, which maxima corresponds with the maxima for *L. truncatula* and *L. peregra*. It is the opinion of the writers, that, since they record *L.*

truncatula over a range of pH 6·0 to 8·6 and *L. peregra* from 7·4 to 8·0, together with the data available for mosquito larvæ, hydrogen-ion concentration is not of vital importance for these forms of animal life. Details are given of all the readings made.

WALTON (C. L.). **The Control of Tick Infestation and a related Disease of Lambs in N. Wales.** *Parasit.*, xix, 3, Sept., 1927, pp. 265–273.

An account is given of a serious infestation in sheep and lambs by *Ixodes ricinus* in the uplands of Denbighshire. This was accompanied by serious disturbance of health, deterioration of the flocks and the death of lambs.

Experimental dippings were commenced in 1924 using a special "short-interval" arsenical dip supplied by the Cooper Technical Bureau, London. Serial dippings were made each spring at five-day intervals, and when possible, an early autumn series was conducted. The objects were (*a*) to control the infestation; (*b*) to control the diseased condition, and (*c*) to attempt to eradicate the ticks from the land.

The control of both the ticks and the disease was easily effected, but eradication was not accomplished, although the average number of ticks was reduced from 121 per animal in May, 1924 to 0·96 per animal in July, 1926. It is, therefore, suggested that short-interval dipping for tick infestation in sheep is practicable on British hill farms.

WALTON (C. L.) & WRIGHT (N. REES). **Agricultural Parasitology. An Introduction.** *Sidgwick and Jackson, Ltd.*, London, 1927, pps. x and 122. Illustrated, 6s. net.

A short book divided into XII Chapters, and an Appendix dealing with Zoological Classification, etc.

The Chapters are (1) Parasitology; (2) Parasitic Protozoa; (3) Trematodes (flukes); (4) Cestodes (tapeworms); (5) Nemathelminthes (round worms); (6) Acarina (ribes and ticks); (7) Hexapoda (insects, general); (8) Anoplura (lice); (9) Diptera; (10) Diptera (contd.); (11) Siphonaptera (fleas); (12) Collection and Preservation of Parasites.

The book is an attempt to supply a short and concise account of the parasites affecting British live stock, and is arranged largely along the lines taken by the course of lectures given at Bangor by the senior writer.

MINISTRY OF AGRICULTURE AND FISHERIES, VETERINARY LABORATORY.

DOYLE (T. M.). **A hitherto Unrecorded Disease of Fowls due to a Filter-passing Virus.** *Journ. Comp. Path. and Thera., II*, 1927.

In this article is described a disease not previously observed in this country, and which appears to be distinct from any recorded disease of poultry. It first occurred in the vicinity of Newcastle-on-Tyne. To facilitate description it has been provisionally named "Newcastle Disease." Three widely separated outbreaks have occurred and in each case the mortality has been about one hundred per cent. As it first appeared near a port it appears probable that it was brought in by shipping from abroad.

Affected birds show a characteristic respiratory symptom very similar to that occurring in infectious bronchitis in America, but the almost complete absence of changes in the trachea would appear definitely to differentiate it from that disease.

Newcastle disease bears many resemblances to 'fowl plague' and a considerable amount of work was necessary before it could be definitely asserted that it was not a chronic form of that disease.

The following are the conclusions arrived at :—

(1) The disease here described, although it bears many resemblances to fowl plague, appears to be a separate entity.
(2) It can be described as an acute febrile, contagious, infectious disease of fowls, which greatly resembles fowl plague ; it is caused by a filter-passing virus and is characterised by a difficulty in respiration and a high mortality.
(3) It can be differentiated from plague by the period of incubation, symptoms, and lesions.
(4) Fowls immune to plague are susceptible to both artificial and natural infection with Newcastle disease ; and fowls immune to Newcastle disease are susceptible to artificial and natural infection with plague.
(5) The virus is contained in the body fluids, organs, and excretions of affected birds.
(6) Filtration experiments have shown that the virus contained in the mouth exudate can pass through Berkefeld, Chamberland, and Seitz filters.
(7) Pigeons, both young and adults, can be easily infected with Newcastle disease, but are very resistant to infection with plague.
(8) The mortality in naturally infected flocks is usually about 100 per cent.

Doyle (T. M.). **B. Aertrycke Infection of Chicks.** *Journ. Comp. Path. and Thera., I,* 1927

Description of a heavy mortality among young chicks due to infection with B. aertrycke. Disease of the lower animals due to B. aertrycke is of primary importance, as this organism is the commonest cause of food-poisoning in man. Infection of poultry is particularly interesting because of a fatal case of food-poisoning, recently reported in the lay press, which was alleged to have resulted from eating an egg.

Infection of chicks with B. aertrycke is a matter of considerable importance, as it gives rise to the possibility of "survivors" acting as carriers of the organism ; and if this occurs the ingestion of the flesh or eggs of these birds may cause food-poisoning in man. In the outbreak here described none of the adult birds, as judged by the agglutination test, appeared to be infected ; and this is borne out by the fact that a considerable number of healthy chicks were bred from these birds during the period the disease was on the farm.

The inoculation experiments showed that adult fowls are very resistant to infection with B. aertrycke.

The origin of the outbreak was not discovered. It may have arisen from artificial manure, with which the land was treated, and the evidence certainly pointed in that direction. On the other hand, it may have been caused through food, contaminated perhaps by mice fæces, as these animals are very susceptible to natural infection with B. aertrycke.

The many points of resemblance between the B. pullorum and the B. aertrycke show the importance of making a detailed bacteriological examination for the diagnosis of bacillary white diarrhoea.

Doyle (T. M.). **Observations on B. pullorum infection of Cock Birds.** *Vet. Journ.*, Vol. 83, No. 6, 1927.

This article deals with the agglutination reactions of affected cock birds, transmission experiments using 'carrier' cocks and healthy hens, and the distribution of B. pullorum in the system of cock birds.

The following are the conclusions :—

(1) As a general rule, the agglutination titre of 'carrier' cock birds is considerably lower than in 'carrier' hens.

(2) When testing cocks, complete agglutination in a dilution of 1:15 should be accepted as indicating infection ; but a second test, after an interval of one month, is advisable to ascertain whether the low titre is due to fluctuations in the agglutinin content of the blood or to their elimination as the result of the bird overcoming infection.

(3) Out of thirteen naturally infected cock birds, the B. pullorum has been isolated from the testes (6), spleen (3), gall-bladder wall (1), and the heart muscle (1).

DOYLE (T. M.) and MINETT (F. C.). **Fowl Pox.** *Journ. Comp. Path. and Thera.*, vol. xl, 4, 1927.

Every case of disease determined by the virus of fowl pox, no matter what may be the symptoms manifested or the lesions produced, should be called fowl pox.

Both comb and mouth lesions in birds affected with fowl pox are due to the same virus. The comb form confers immunity against the mouth form and vice versa.

There is no evidence that bacteria alone produce typical false membranes. Though it is possible that bacteria may play an important secondary part, the preliminary action of the specific virus is essential.

The fowl pox virus may be associated with roup. The use of the term 'roup' should be restricted, however, to the conditions characterised by catarrhal inflammation of the conjunctiva and upper air passages, when these are unaccompanied by lesions of fowl pox in any bird of the flock.

Strains of fowl pox virus have been obtained from twelve separate outbreaks. Cross-immunity tests have shown these to be indistinguishable immunologically.

Pigeons could be successfully infected with fowl pox virus by frequent passage on the skin of the leg. The viruses of fowl pox and pigeon pox are immunologically indistinguishable.

Cow-pox virus produces characteristic lesions on the fowl's comb. Frequent passage of cow-pox virus through fowls failed to change the character of the lesions, or to bring about a resemblance to the lesions of fowl pox.

Certain results of fundamental importance in the control of the disease were obtained. In the first place, direct contact between diseased and healthy birds is necessary for the spread of the disease, and the virus does not pass through unbroken skin. Secondly, experiments failed to provide any evidence for the existence of disease carriers. The investigators were unable to demonstrate the persistence of the virus in the internal organs of recovered birds, or on the comb after complete disappearance of lesions.

MINETT (F. C.). **Experiments on the Larger Animals at the Research Station, Pirbright, Surrey.** *Second Prog. Rept. Foot and Mouth Disease Committee.*

(*a*) Types of foot and mouth virus.

In experiments with cattle, sheep, pigs and guinea pigs the work of Vallée and Carré on the existence of two types of virus, called A and O respectively, was confirmed.

Of seventeen strains received from twelve centres of disease in Great Britain sixteen belonged to the O type and one to the A type. For practical purposes the types are distinct though a certain degree of cross-immunity develops.

On three occasions accidental infections were observed, in which cattle immune to one type were infected with virus of the other type.

The characters of two selected British strains (A & O) from cattle were found to be relatively fixed.

The opportunity was taken to study the disease in susceptible animals from the clinical point of view.

(*b*) Contact experiments.

The disease was not observed to spread from cattle to guinea pigs and cattle do not acquire the infection easily from guinea pigs.

(*c*) Duration of immunity in cattle.

The general immunity of cattle lasted for at least 13½ months.

(*d*) Immunisation of cattle.

Cattle which had received injections of protective serum followed by living virus acquired an active immunity lasting for at least three months.

Preliminary experiments carried out under the direction of Dr. J. A. Arkwright of the Lister Institute with virus killed with formalin showed that cattle may be protected to a certain extent against living virus inoculated intramuscularly.

MINETT (F. C.). **Experiments at the Ministry's Laboratory at New Haw, Weybridge.** *Second Prog. Rept. Foot and Mouth Disease Committee.*

(*a*) The virus.

The activity of a guinea pig-adapted virus was investigated and experiments were conducted on cultivation in vitro.

(*b*) Survival of the virus in guinea pig carcases.

(1) Storage at different temperatures.

At 2° to 7° C. blood remained virulent for 21 to 46 days, bone marrow up to 96 days and kidney tissue up to 54 days. Virus could be detected exceptionally in the muscular tissue.

Fresh lesions on the carcase remained virulent for at least 102 days. At 18° to 20° C. such lesions remained virulent for 11 to 18 days only.

In spite of advanced putrefaction blood remained virulent at 18° to 20° C. for at least 7 days and bone marrow for at least 8 days.

(2) The effect upon the virus of a number of commonly used solid and liquid brine mixtures was investigated. In most of these mixtures the virus in epithelium remained alive for at least 5 days at laboratory temperature.

(3) Survival of virus in buried guinea pig carcases.

Experiments carried out during the summer months.

In the heart blood the virus retained its infectivity for about 10 days and the bone marrow up to 18 days. Fourteen days was the longest period for which feet lesions remained infective. Lime could not be shown to exert an influence upon the duration of infectivity.

(*c*) Survival of the virus in the carcases of large animals.

The muscular tissue was not found to retain a dangerous infectivity but the bone marrow was capable of setting up infection for at least 42 days in the case of bacon carcases stored at freezing or chilling temperatures or treated by wet or dry-salting processes.

In the case of both a beef carcase and a bacon carcase stored at freezing temperature the bone marrow retained living virus for 76 days. Pigs could be infected with comparative ease by feeding with crushed bones containing infective marrow.

(*d*) Attempts to infect birds, dogs, cats, and hedgehogs.

(1) Birds. The virus is rapidly destroyed when inoculated into fowls and small birds such as sparrows and martins. When large amounts of infective material are fed to fowls, traces of living virus may be detected in the fæces of a minority ten to 26 hours later.

(2) Dogs and cats. Slight lesions were produced in 3 out of 32 dogs and 6 out of 20 cats. Virus scarified on to the lips occasionally persisted locally up to 3 days. Deaths in young animals were common after inoculation but no contact infections were observed.

(3) Hedgehogs. Two specimens were infected with virus from guinea pigs.

MINETT (F. C.). **Standardisation of Protective Serum.** *Second Prog. Rept. Foot and Mouth Disease Committee.*

Attempts at standardisation by various in vitro methods were unsuccessful. At present it is possible to estimate the value of serum only by the use of animals. For this purpose the guinea pig is to be preferred.

One suitable method is to determine the smallest amount of serum which is capable of preventing generalisation of the disease in guinea pigs inoculated with virus. This method has been investigated and its limitations ascertained. Though the results have a tendency to be somewhat irregular, useful information as to the value of serum may be obtained.

MINETT (F. C.). **Immunisation of guinea pigs and the nature of the immune state.** *Second Prog. Rept. Foot and Mouth Disease Committee.*

Most of this work was carried out with subinfective amounts of living virus introduced by routes other than the skin. In some cases larger amounts of living virus were given under the protection of immune serum. An active immunity usually develops under these conditions. The evidence points to the immune state being dependent upon the existence of humoral anti-bodies. A true cellular immunity confined to the cutaneous epithelium could not be demonstrated.

MINETT (F. C.). **Action of certain Reagents upon the Virus. Disinfection.** *Second Prog. Rept. Foot and Mouth Disease Committee.*

The effect of a number of reagents upon the virus has been tested.

The most important result discovered from a practical point of view was the relative inefficiency of the phenol and cresol disinfectants. In the presence of small amounts of organic matter the chlorine compounds and certain metallic salts, particularly those of copper, have a high activity. These reagents lose much of their efficiency when larger amounts of organic matter are present.

For many disinfectant purposes formalin has been found to be especially useful.

(11) AGRICULTURAL ENGINEERING.

INSTITUTE OF AGRICULTURAL ENGINEERING, OXFORD.

Cameron Brown (C. A.). **Electricity in Agriculture.** *Journ. Min. Agric,* Vol. xxxiv, Nos. 2 & 3. May and June, 1927.

These two articles deal with the laws governing the economic supply (Part I) and the economic use (Part II) of electricity, particularly with reference to agriculture. A company's tariff must ensure a certain return on capital outlay; where consumers can keep their consumption of current even, in other words reduce maximum demand, a company can supply more consumers at a lower individual rate. Where several machines are driven by one motor (group-drive) the cost of current is greater; where each machine has its own motor (unit-drive) less current is consumed but the farmer's capital outlay is greater. A compromise is advisable. An arrangement of farm machines which would allow the use of smaller motors, would benefit both the farmer and the supply company.

Owen (B. J.). **Agricultural Engineering.** *Agric. Research in 1925,* R.A.S.E., pp. 44–73. 1926.

This contains a summary of the most important features of research in agricultural engineering during the year 1925. As, however, it was compiled for the first annual volume of the kind issued by the R.A.S.E., it was thought well in some cases to go rather further back and to trace the history of certain implements from the time when they began to assume something of their modern form. In the preparation of this summary, American and European literature was laid under contribution. The main heads with which it deals are testing of agricultural machinery, general works on the history of implements, drainage and reclamation and the use of power in agriculture. The chief classes of machinery dealt with include the plough and the rotary cultivator, drills and corn, potato and sugar-beet harvesting machinery. Reference is also made to the investigations conducted at the Institute into the artificial drying of crops in the stack and to the drying of sugar beet. A full bibliography is appended.

Owen (B. J.). **Investigation into the Desiccation (de Vecchis) Process for producing Sugar from Sugar Beet.** *Progress Report.* London, H. M. Stationery Office, 1926.

This gives an account of the work at the Sugar Beet Experimental Factory, Eynsham, near Oxford, which was undertaken to test a process for drying sugar beet and extracting sugar from the dried product. Reference is made to the Report of a Commission of Enquiry which visited Italy in the winter of 1924–25, and to the work already done by the Institute on the question of dehydrating vegetable products. A short account is given of the laboratory investigations into the special problems presented by the drying of beet cossettes, and of the methods adopted for the extraction of the sugar and the subsequent purification of the high-density juices. A careful chemical control was carried out at all stages of the process with a view to ascertaining the best conditions for the avoidance of caramelisation and inversion. So long as the temperature to which dried, or practically dried, cossettes were exposed did not exceed 230–F., it was found that neither of these deleterious effects were produced. Shortening of the period of drying was also found to be efficacious in this respect. A considerable amount of attention is given to the economic side of the question, and calculations are given showing the saving which would be effected by the adoption of the process. The main saving would be in capital cost of the factory, as, owing to the fact that it could operate all the year round, instead of for only a third of the year, the factory for the desiccation process would only need to be about one-third of the size of the

ordinary factory. The advantage of permanency and consequent increased efficiency of labour is also referred to. If drying apparatus were employed either by individual farmers or groups of farmers, a considerable saving would be effected in transport.

OWEN (B. J.). & others. **Some Discoveries in the Treatment of Sugar Beet.** *Journ. Min. Agric.*, Vol. xxxiii, No. 11. Feb., 1927.

This article gives a short history of the investigations of previous workers into the drying of beet for the extraction of sugar, and proceeds to describe certain methods and processes developed during the course of the Institute's research. Drawings are given with descriptions of a conveyor drier, a method of drying in stack and a tray drier, in all of which the principle of mass drying is adopted.

It has been found that desiccation is effected to the best advantage by controlling the consolidation of the mass of material and promoting slight natural reactions, by supplying the heated air to the mass at certain ranges of temperature, pressure and volume, which are selected and co-ordinated, so that the rate of dehydration is increased to the greatest possible extent, and the effects of the smallest exothermic reactions are utilised to the best advantage, and danger of caramelisation and invert-formation as far as possible obviated.

A new apparatus for extraction by continuous diffusion is described and figured. This consists of a vertical extraction vessel to which the dried beet cossettes are fed continuously, and impelled upwards by means of an Archimedean screw, the sugar being extracted by means of a counter-current of water, which is caused to gravitate continuously through the ascending material. A description is also given of a method of purification, which simplifies and expedites the treatment of the raw juices obtained and produces a final liquor more highly purified and more readily crystallizable than that obtained by processes hitherto in vogue.

ROTHAMSTED EXPERIMENTAL STATION.

HAINES (W. B.) & KEEN (B. A.). **A new dynamometer suitable for all types of implements and traction.** *Proc. 1st Intern. Congress Soil Sci.*, Washington, D.C., 1927.

The dynamometer used by the authors and described in the 1925 Report of the Station has been replaced by one that is much lighter. more accurate and reliable, and simpler in construction. It can be used for all types of work from the lightest horse-drawn implement to the heaviest steam traction. A full description will appear in the Journal of Agricultural Science.

(12) AGRICULTURAL ECONOMICS.

AGRICULTURAL ECONOMICS RESEARCH INSTITUTE, OXFORD.

Bridges (A.) & Dixey (R. N.). **Sugar Beet and Soil Fertility.** *Journ. Min. Agric.*, Vol. xxxiii, No. 11. Feb., 1927.

A study of the gains and losses to the soil in growing sugar beet based on actual farming practice.

Bridges (A.) & Dixey (R. N.). **Sugar Beet in Oxfordshire.** *N.F.U. Year Book (Oxon Branch)*, pp. 6. 1926.

The financial results of growing sugar beet in Oxfordshire, with a consideration of some factors affecting future development in this country.

Bridges (A.) & Dixey (R. N.). **Sugar Beet Costs and Returns.** *Agric. Econ. Res. Inst., Oxford*, pp. 71. 1925/6.

This Monograph forms a sequel to a similar study by the same writers for the 1924 crop and contains the results of an inquiry into the financial and economic aspects of the sugar beet crop for the latest year for which complete information is at present available. The fifty-three costs on which the study is based have been grouped according to variations of soil and district, and the costs of the crop both for land and materials are discussed in turn. Considerable attention has been given to a detailed study of the labour costs for each stage of the cultivation of the crop. Comparisons are also drawn between the results of the two years.

A chapter is devoted to the question of the risk of failure, and another deals with the various means adopted in disposing of the tops and leaves. The value to the farmer of these by-products, according to the methods of utilisation, has been estimated. The difficulties encountered by farmers before deciding to buy pulp from the factories are also touched on, and a table is given showing the value of the subsidy.

Throughout the book attention has been drawn to points which seem to offer scope for improvement and in the concluding statement some of the difficulties confronting the future development of the industry are mentioned.

FitzRandolph (H.) & Doriel Hay (M.). **The Rural Industries of England and Wales.**

Vol. I.—Timber and Underwood Industries and Some Village Workshops.
Vol. II.—Osier Growing and Basketry and Some Rural Factories.
Vol. III.—Decorative Crafts and Rural Potteries.

Jones (A. M.). **Vol. IV.—Rural Industries in Wales.**

Oxford University Press.

These volumes are studies descriptive of the nature and present conditions of the surviving rural industries of England and Wales, together with some suggestions arising out of the investigation for the improvement of the economic position of the workers engaged in them. The investigation is the most complete that has been undertaken, and the series of reports will have a considerable historical value. At the same time the reader is reluctantly forced to the conclusion, however, that few of the ancient rural crafts of Britain can survive in the face of modern mass production and the limited appreciation of good craftsmanship.

Frecheville (G.). **Higher Farming.** *Journ. R.A.S.E.*, 1926.

In this paper the writer gives many illustrations to show the danger that may lie in attempting to meet falling prices by securing a higher output.

LIVERSAGE (V.) **The Economics of Production of Grade A (Tuberculin Tested) Milk.** *Oxford University Press.*

An investigation was carried out on farms in Bucks, Berks, Oxfordshire, Hampshire, Surrey and Dorset, to ascertain the additional costs incurred by producers of Grade A (T.T.) milk. The figures indicate that there is no great financial inducement to the farmer to reorganise his methods of production with this object, at the price at which the commodity is sold, for the higher figure at which the cleaner milk is sold appears just to balance the extra costs incurred. The report makes a careful analysis of these costs, showing what is due to capital charges, such as the improvement of cowsheds, provision of water supplies, and the extra equipment for cooling and handling the milk, the cost of rejected cows, and the cost of additional labour services. It is noteworthy that the last item accounts for more than one half of the total extra cost of producing this higher grade milk.

MAXTON (J. P.). **Rural Scotland During the War.** *Econ. Journ.* Mar., 1927.

A paper describing farming operations in Scotland during the period indicated in the title. Scottish agriculturists worked under the same disabilities as those in England and Wales, and made equal efforts to overcome them so as to meet the needs of the great emergency.

ORWIN (C. S.). **The Transition of Agriculture.** *Journ. Royal Soc. Arts,* May, 1927.

This paper (which was awarded the Silver Medal of the Society) traces chronologically the great transitions in the history of agriculture in Britain and proceeds to indicate the probable course of imminent transitions which are being imposed on the industry by a standard of living dictated to agriculture by the conditions prevailing in urban industries,—a standard higher than that known in rural life in any other country, and one which can only be secured by changes in farming which will increase the product-value of the unit of labour.

ORWIN (C. S.). **The Teaching of Agriculture.** *Agric. Econ. Soc.*

In this paper a plea is entered for a revolution in the accepted method of instruction in agriculture, by which economics would become the fundamental science instead of chemistry and biology.

PREWETT (F. J.). **The Marketing of Farm Produce. Part I—Livestock. Part II—Milk.** *Oxford University Press.*

In these studies the author has considered the problem of better marketing purely from the standpoint of the practical farmer, and has avoided, so far as possible, merely academic consideration of the subject.

Part I gives a full description of the present methods of marketing livestock, and discusses the respective functions, useful and otherwise, of the various agents, dealers and auctioneers, concerned in its distribution. The point is emphasised that there is no need for fat stock to enter the market at all, and that it should be possible to arrange direct trading between the organised producer and the organised consumer by means of an intelligence service to direct the flow of supplies.

Part II describes the growth of the great wholesaling organisations handling milk, and shows that the dairy farmer will never be able to bargain with them so long as the manufacture of the great surplus production is entirely in their hands.

PREWETT (F. J.). **The Marketing of Livestock.** *Journ. R.A.S.E.*, 1926.

This is a brief résumé of the principal points which emerged in the writer's larger publication upon the same subject.

THOMAS (E.). **The Economics of Small Holdings.** *Cam. Univ. Press.*

This book embodies a study of the scale of production on small holdings of certain types and sizes, and the rate of renumeration of those engaged in work upon them. It is based upon a very careful and complete survey of a small holdings community in Wales. The principal facts which emerge are that the scale of production varies inversely with the size of the holding, but that the return on the capital and labour invested varies directly with the size. Further, that if the hours of labour are taken into account, the labour-income of these small farmers is less than that of agricultural labourers in the same district on all holdings except those engaged in the production and sale of milk.

ARMSTRONG COLLEGE, NEWCASTLE-UPON-TYNE.

DINSDALE (D. H.) & DAVIES (J. LL.). **Sugar Beet in the Northern Counties, 1926. Report on the Results of an investigation into Costs and Returns.** *Armstrong Coll., Newcastle-on-Tyne*, pp. 15.

Sugar Beet was grown generally for the first time in the Northern Counties in 1926. The Report presents the results of an investigation carried out by the Advisory Agricultural Economics Branch of the Department of Agriculture, Armstrong College, Newcastle-on-Tyne, during the winter of 1926, into costs and returns relating to Sugar Beet.

Results are presented from ten farms in the County of Durham. The value of the results is limited by the smallness of the sample.

The average yield of washed Beets for the ten farms was 8·48 tons per acre, which compared with 8·76 tons for the whole country. The highest yield recorded in the group was 10·7 tons, and the lowest 5·2 tons per acre. The average sugar content was 17·27 per cent. with a range from 16·1 to 18·9 per cent. The average cost of growing one acre of Sugar Beet on the ten farms was £20 15s. 11d. Approximately one third of this amount is represented by haulage costs.

The average gross returns per acre were £25 4s. 10d., and the average margin of returns over direct costs was £4 8s. 11d. per acre. This margin was not profit or loss in the usual sense, but was the measure of the contribution made by Sugar Beet Crop towards overhead expenses, none of which were included in the statement of costs.

Allowing for the experimental character of these first attempts to grow the crop, and for improvements in methods of cultivating, lifting and manuring which further experience might be expected to bring about, the margins obtained in the best cases definitely suggested that sugar beet was worth a more extended trial.

In addition to the data relating to sugar beet, the Report contains suggestions as to the general principles which might be applied in pursuing investigations of this kind.

UNIVERSITY COLLEGE OF WALES, ABERYSTWYTH.

ASHBY (A. W.) & PRYSE HOWELL (J.). **Rents and Prices of Agricultural Land in South Wales. 1915—1925.** *Welsh Journ. Agric.*, Vol. iii. 1927.

Records of sales of 1,330 agricultural holdings in seven counties in South Wales for the period 1915–1925 have been collected. The numbers for the

individual counties are shown in the table of analysis. For 407 cases details of acreage and purchase price only were obtained, but for the other cases information on gross rental previous to sale, acreage and charges has usually been obtained.

For a group of 717 farms, the rates of year's purchase on land of varying potentialities and different rentals are summarized. The *gross rental* is shown and on this basis the average year's purchase of the whole of these holdings is just under twenty-six. Taking the *net rent* (gross rent less such charges as tithe and land tax) the average of between two and three years would be added to the year's purchase of all the farms subject to charges, but over the whole group of 717 farms the year's purchase on net rent would be increased by only a few months.

The relatively high capitalisation of the values of the poorest land is remarkable and on land of an average rental value of 2*s*. 5*d*. per acre with little or no sporting values, and where a decline in demand for sheep and in prices would reduce its value, the year's purchase is nearly twenty-six. For poor land with rentals varying from 5*s*. to 20*s*. per acre the year's purchase varies from 28/6 to 29/4. Probably the high profits on sheep farming would have some influence on the high capitalisation of the poorest land, while on the relatively poor land many of the farms were small and let at low rentals and therefore offered possibilities of purchase to a large group of persons. The actual gross rentals at the higher levels were nearer to the real level of competitive prices.

In the table showing the average rents of sales by size of holding is indicated that in general, rents, purchase price per acre, and year's purchase fall as the size of the holding increases.

A summary of the sales of farms by periods shows that the highest prices and years' purchase on the average were obtained in the years 1919–1922, but as a yearly capitalisation the difference between this and the earlier period is not marked.

Ashby (A. W.). **Salesmanship in Agricultural Co-operation.** *Welsh Journ. Agric.*, Vol. iii. 1927.

The psychology of selling requisites to farmers is discussed with special reference to the business of Agricultural Co-operative Societies in Wales, but some principles suggested are applicable elsewhere. Types of buyers are described, with reference to knowledge and personal characteristics. Some buyers purchase on a basis of valuation of goods as means to ends, others are influenced by prejudices or by characteristics of goods which have a personal appeal to them. The importance of personality in the salesman is noted, and the value of the power of suggestion in selling is emphasised. Sympathy and the power of suggestion are strong elements in personal influence, and it is on the personal characteristics of the salesman, as seen by the buyer, as well as on the quality and price of goods that successful salesmanship depends. The use and abuse of price-lists is discussed. Carefully used, the price-list may be a definite aid to selling, but it should never be expected to take the place of personal contact between salesman and prospective buyer. Principles and methods of price-fixing by societies are described, and the conclusion stated that, although minimum prices offered by sellers and maximum prices estimated by buyers are fixed by economic forces, the actual price at which the transaction is made is largely fixed by the feelings and judgments of the two persons concerned. The credit policies of societies and the relationship between the Manager or Salesman and the Society are also discussed. The business of an Agricultural Co-operative Society is a complex of human factors and success is as much dependent upon the handling of these as upon the more purely economic conditions.

Ashby (A. W.) & Morgan Jones (J.). **The Relation of Prices to Production of Pigs.** *Journ. R.A.S.E.*, Vol. 87. 1926.

This article is an attempt to throw further light on the intricate problem of marked cyclical variations in the prices of pigs and pig products. In the opening paragraphs, current theories are discussed and criticised on the grounds that they do not allow for the many factors which come into operation. While admitting the apparent relationship of cause and effect between pig population and prices, and maize production, the authors suggest other sources of information and lines of inquiry which should be pursued in attempting to solve the problem.

The scarcity of information on the subject precludes the possibility of conclusive results being obtained, but available statistics pertaining to the demand and supply sides of the problem are analysed. Since about 1890 the consumption per capita of pig products in this country has been increasing and the demand for fresh pork is being extended over the whole of the year. The way in which potential demand is linked up with the available supply is shown in statistics for 1909–19, showing the considerable differences in rates of slaughter of pigs.

Changes in home pig population are then studied and the graphs show the existence of a regular cycle of about five years between maximum or minimum. The intricacy of the problem is realised when pig population, supplies and prices of maize and of pig products are correlated. While several apparent correlations can be found, a conclusive statement of cause and effect is almost impossible with the available stock of information. With the greater interest now taken in pig husbandry this will probably be forthcoming and it is hoped that information for forecasting prices will be collected. The monthly records of boar services on some farms in Wales supplies the basis for further studies in this direction. The classified table shows the influence of prices on breeding policy. When prospects are good more sows are mated, and the effect of this on pig production is cumulative. The comparative concentration of mating into two periods of the year indicates that at such times the price of weaners is the predominant factor determining the supply of weaners in six months' time.

It is hoped that further study of this subject will yield practical information which will enable producers to avoid some, at least, of the losses which now seem to be inherent in this semi-speculative sphere of farming.

Ashby (A. W.) & Meredith (H. J.). **Selling Livestock in Wales.** *Welsh Journ. Agric.*, Vol. iii. 1927.

Methods of selling livestock in Wales are described in a general way and with special reference to the information possessed and used for trading purposes by buyers and sellers. The predominance of private treaty sales on farms and in market towns is a remarkable feature; and it is suggested that the reasons for this are personal rather than economic. Personal relations with dealers are very strong, habits and customs are established, and farmers find in the personal selling of their stock the most interesting task which comes to them in their business activities. Publicity is one of the essentials of an efficient marketing system, but Welsh farmers have little information on the trend of supplies, requirements and prices. Certainty and accuracy are not always obtainable in market quotations. The psychological process of buying and selling is described and analysed and a general weakness in sellers' knowledge and judgment is suggested. Methods which will give more publicity and greater accuracy in quotation are necessary: organised auctions under farmers' control are suggested. Strong leadership will be required for progress in livestock marketing. Public authorities could assist by providing better facilities for markets.

Ashby (A. W.) & Pryse Howell (J.). **Success in Farming. Its Nature and Determination.** *Journ. Surveyors' Inst.* Vol. vi., Part 6. Dec., 1926.

Success in farming is always a personal matter, and every true study of economic causes of success and failure will take into account the "human factor." The consequence of economic measurement of success in farming is to turn attention solely upon financial aspects. "Profit" is an incomplete measure of success because it fails to indicate the spending as well as the getting of the money. A good standard of living must be one of the results of true success. The constituents of success in farming are (1) "good farming"; (2) "fair business"; (3) "profits"; (4) good "living. Standards of judgment of success in farming must be relative to period, locality, and type and size of farm.

Ashby (A. W.). **Success in Farming.** *Essex County Farmers' Union Year Book.* 1927.

An extension of "Success in Farming" by Ashby and Howell (see above). Commercial farming is a process of using land for producing foods for the maintenance, extension and improvement of life, through exchange and consumption. Production, profits, material and non-material standards of living have all to be taken into account in judging success. Farmers themselves judge by (1) technical efficiency; (2) neighbourliness; (3) business capacity; (4) use of income. Possibilities of variations in success in one or more items are noted.

A possible score-card for scoring success in farming is indicated. Profit is not necessarily a measure of complete success. It is used because it is obvious and more definite than others.

The importance of neighbourliness, in its agricultural as well as in its general social aspect, is emphasised: development of farmers' organisation requires more "working with a team." Good living is evidence of present but also one of the foundations of future success.

Pryse Howell (J.) and Meredith (H. J.). **Farmers' Cost of Milk Delivery in Wales.** *Welsh Journ. Agric.*, Vol. iii. 1927.

This study shows the cost of the distribution of milk for the years 1924–25 under different systems. Forty-one farms in Breconshire and sixteen farms in the counties of Pembroke, Carmarthen and Denbigh contributed and these provide examples of almost every system of distribution which exists in the Principality.

In the case of Breconshire the methods employed in the delivery of both wholesale and retail milk are set out in fair detail, and the conditions obtaining may be taken as being fairly representative for the whole of Wales.

In arriving at the costs only a proportion of the expense of keep, and depreciation of horses or vehicles has been charged to milk and this has been assessed on the amount of time worked. Full depreciation on churns, cans, measures, &c., has been allowed and a depreciation of 10 per cent. on horse equipment has been allowed and 20 per cent. per annum on motors. Interest on capital is also included but alternative costs not including interest are given.

Wholesale delivery costs for the Breconshire farms (including interest on capital) range from ·67*d.* to 2·79*d.* per gallon and excluding interest charges from ·61*d.* to 2·60*d.* per gallon. For the other areas the range is from ·36*d.* to 2·05*d.* per gallon (including interest charges) and from ·34*d.* to 1·79*d.* per gallon (excluding interest charges).

The summary of the Breconshire farms shows an average cost of 1·54*d.* per gallon for farms delivering by horses and 1·27*d.* per gallon for farms where motors were used. The average wholesale delivery costs for the 'other

acres were 7s. 1d. per gallon where delivery was made by horses and 9½d. per gallon in the case of delivery by motor. Manual labour accounted for about half the total costs.

Gross density costs, including interest charges for the Breconshire farms ranged from 7½d. to 7·8d. per gallon, and, excluding interest charges, from 5·8d. to 7·0d. per gallon. Farms delivering by horses showed an average cost of 8d. per gallon, those delivering by trucks or vans 4d. per gallon and one farm which delivered by motor-cycle showed a cost of 6·25d. per gallon, and in all cases the manual labour constituted the heaviest item. Retailing costs were only available for two farms in the other areas and these were for very good rounds and the average cost of retailing, which was done by horses, was 2·43d. per gallon.

UNIVERSITY OF LEEDS.

R. Scott, A. C. J. Svendsen [*sic*]. **Danish Bacon Factories and Their Lessons.** *Journ. Min. Agric.*, Vol. xxxiii, No. 7. Oct., 1926.

This is an account of the lines on which bacon factories are conducted in Denmark, with an analysis of the accounts of eleven representative factories situated in various parts of the country. There is a brief sketch of the growth of the bacon system, the accompanying rise in the pig population in Denmark and the corresponding increase in the exports of bacon to other countries.

The price obtained for the Danish product is discussed and the costs of production are considered in detail. Several factors are cited which have contributed very largely to the success of the Danes in this industry. The manner by which the interests are financed is also dealt with and the factory system is shown to have greatly benefited both producer and consumer.

UNIVERSITY OF READING.

N. S. J. S. **Labour Requirements of Arable and Grass Lands.** *Agric. Prog.*, Vol. iv. 1927.

It is often assumed that the amount of employment agriculture can offer depends upon the proportions in which arable and grass land exist, and that a prolonging of policy will necessarily increase the amount of employment. Data collected from about 50 farms suggest that a general statement to that effect without qualification may well be true at the present time. The farms are of varied types taken from areas ranging from Yorkshire to the South coast. The plotting of hours worked per acre against percentage of arable gives a curve of which the trend is fairly horizontal, reaching a maximum of about 40 per cent. of arable, but at all points of the curve are farms giving a high and low employment with equal percentages of arable. The preliminary conclusions of the data are:—

1. The proportion of land under arable cultivation is not in itself an indication of its capacity for providing employment for labour.

2. The labour requirements of farms are influenced mainly by the system of farming practised, that is, by the kind of stock carried and the character of the crops grown. Further work is proceeding to elucidate this problem.

N. S. J. S. **Cost accounting applied to Agriculture as an aid to more Productive Farming.** *Oxford Univ. Press.*

This work embodies a critical discussion of cost accounting methods at present advocated in this country and abroad. The part cost accounts can play in aiding the farmer in managing his farm, and their wider usefulness as part of the machinery of investigation of the economic problems of agri-

culture in the hands of the agricultural economist, are considered, with illustrations drawn from practical cases. The costing of individual products is rejected as unsound for the greater number of agricultural commodities, in favour of the assessment of the relative cost and returns from alternative processes or methods open to the farmer.

SOUTH-EASTERN AGRICULTURAL COLLEGE, WYE.

WYLLIE (J.). **Investigation into Farming Costs of Production and Financial Results. Report No. III. The Cost of Horse Labour with Notes on Tractor Costs.** pp. 71–98.

This report deals with the cost of horse-labour on from 16 to 20 farms in the counties of Kent, Surrey, East Sussex and West Sussex during the period Michaelmas, 1923, to Lady Day, 1927. All the data are taken from complete cost-ledgers. Full details are given as to (1) the average cost per horse per annum; (2) the relative importance of the different cost items; (3) the average quantities of food consumed per horse per annum; (4) the number of horses per 100 acres; and (5) the causes of the variations in the cost of horse labour from farm to farm.

WYLLIE (J.). **Investigation into Farming Costs of Production and Financial Results. Report No. IV. Preliminary Note on Three Years' Financial Results.** pp. 99–102.

This report gives the net profit or loss on eleven typical farms in the south-eastern counties for each of the three years ending at between Michaelmas, 1926 and Lady Day, 1927, and also an analysis of the profit and loss accounts showing, for each year, the profits and losses on the different "departments." All the data are taken from complete cost ledger accounts. Over this period, these farms gave a gross return, to meet interest charges, managerial salary and net profit of 3·4 per cent. or 14s. per acre, the results being much worse in the third than in the first year.

WYLLIE (J.). **Some Popular Fallacies in Farming Economics.** *Trans. Highland and Agric. Soc., Scotland,* 1927. pp. 1–24.

In this essay an attempt is made to expose some of the common fallacies in farming economics which are a common source of misunderstanding, of misdirected criticism and of misleading advice. Special attention is given to the doctrine of low-farming as a remedy for low prices and to the idea that prices should be fixed according to costs of production. Certain "political" fallacies are also discussed and a strong protest is made against the notion that farmers are "standing still."

WYLLIE (J.). **The Present Position of Arable Land with regard to Labour Costs.** *Journ. Farmers' Club,* Mar., 1927, pp. 21–29.

This is a paper read before The Farmers' Club. The difference between "wages" and "the cost of labour" is emphasised and a strong plea is made for basing conclusions and advice upon the Profit and Loss Account. The various ways in which the cost of labour might be economised are described, but the writer has "no panacea to offer." Special reference is made to the need for a better understanding between employers and employees and to the harm that is done by the wrong use of labour statistics.

WYLLIE (J.). **Some Causes of the Variations in the Financial Results of Farming.** *Journ. S. E. Agric. Coll.*, 1927, pp. 173–180.

The main object of this paper is to show that the variations in the financial results of farming are not necessarily, or even mainly, due to differences in managerial capacity but that they are due to the extreme variations in the conditions under which farming is carried on. It is emphasised that success in farming should be judged mainly, though not entirely, by the profit and loss account and not, as it is so often at present judged, by mere "appearances."

SEALE HAYNE AGRICULTURAL COLLEGE, NEWTON ABBOT.

LONG (W. H.). **An Economic Investigation of Devon and Cornish Farms, 1923–24—1925–26.**

This report deals with the accounts of 31 farms in 1923–24, 45 in 1924–25, and 60 in 1925–26. Comparisons are made (*a*) of profits and losses in each of the three years, (*b*) of the systems of farming in each of three localities in which the majority of the farms are situated. The figures go to show that, after making allowances for unpaid family labour, a profit was made in 1924–25, but in both 1923–24 and 1925–26 losses were incurred. Sufficient data are not yet available for anything conclusive to be said as to the relative merits of the systems of farming in different localities.

MINISTRY OF AGRICULTURE AND FISHERIES.

Report on the Marketing of Poultry in England and Wales. *Ministry of Agriculture and Fisheries* (*Economic Series No.* 11). *Published by H.M. Stationery Office*, price 6d. net.

This publication gives the results of a detailed investigation into the marketing of poultry in England and Wales. The methods employed and the services involved at each stage of the marketing process are reviewed, and comparison is made where possible and useful with corresponding activities in other countries. As a result of the investigation, it is stated that there are directions in which the marketing of poultry can be improved in England and Wales, and some in which reform is long overdue. There is little or no standardisation of production to meet market demands and no uniform classification of products. The methods employed in preparation for market are poor, and there is general lack of knowledge of market conditions and requirements.

Report on the Marketing of Pigs in England and Wales. *Ministry of Agriculture and Fisheries* (*Economic Series No.* 12). *Published by H.M. Stationery Office*, price 6d. net.

This report is based on an enquiry into the marketing of pigs in England and Wales, and gives a descriptive account of the methods employed and of the services involved at each stage of the marketing process. While the demand for pork and bacon has increased with the increase in population, the number of pigs in the country remains much about the same as it was fifty years or more ago, whereas in the same period the number of pigs in Denmark has increased fivefold, and in Holland has more than doubled. It is in the direction of the bacon industry that producers must look for a market if pig production is to be substantially and permanently increased in this country. Various reasons can be suggested for the inability of the English bacon industry to respond to the increasing demands of the bacon market. The report shows that progress will only be possible as a result of a well planned effort in which producers and curers work together for mutual benefit.

Markets and Fairs in England and Wales. Part I. General Review. *Ministry of Agriculture and Fisheries* (*Economic Series No.* 13). *Published by H.M. Stationery Office,* price 6d. net.

In furtherance of a recommendation made by the Linlithgow Committee, a survey of the agricultural markets and fairs of England and Wales has been undertaken by the Ministry of Agriculture and Fisheries in connection with, and complementary to, its investigations into the marketing of agricultural produce. A knowledge of the markets of the country is essential if the methods of marketing agricultural produce are to be fully understood. This Report is of an introductory character and provides the "perspective" for the more detailed Reports to follow surveying the markets in various areas of the country. The Report commences with an historical chapter and goes on to deal with market charges and finance. After discussing the development and classification of markets, retail markets and wholesale produce markets are surveyed and two chapters are devoted to livestock markets. Another chapter is devoted to abattoirs, cold-stores, and hide and skin markets. The volume collates a good deal of useful information which will be appreciated by farmers and others interested in agriculture.

Markets and Fairs in England and Wales. Part II. Midland Markets. *Ministry of Agriculture and Fisheries* (*Economic Series No.* 14). *Published by H.M. Stationery Office,* price 6d. net.

This Report gives a close-up view of market facilities in the Midland Counties. It is designed to remedy the lack of readily available information regarding the markets in that part of the country and covers an area from Monmouthshire to Lincolnshire and from Cheshire to Cambridgeshire; it will be followed in due course by similar Reports relating to other areas. A general section deals with markets as a whole, classifying them by commodities and including reference to fairs for horses, sheep, cattle, etc.; the main body of the Report describes individual markets county by county. The Report is completed by detailed appendices including a complete list of all the markets in the Midland area arranged alphabetically by counties. This appendix contains, for each market, information as to the market days, the market occupier, the covered and uncovered area of the market, the commodities sold, the method of sale and other relevant data. Other appendices classify livestock markets according to turnover of stock and furnish a list of agricultural fairs by counties showing the dates when they are held and the commodities sold.

Report on Fruit Marketing in England and Wales. *Ministry of Agriculture and Fisheries* (*Economic Series No.* 15). *Published by H.M. Stationery Office,* price 6d. net.

This report has the object of providing home growers with a comprehensive view of the methods of marketing fruit, and enabling them more easily to consider what further steps can be taken by them to maintain their present position in the home market, and also if possible to increase their share of the total trade. The conclusion seems to be that the fruit industry generally has much to gain by adopting methods of marketing which will enable produce to be put on the market in a manner more in accordance with requirements of wholesalers and retailers. Agreement on standard grades and packages is one method which can hardly fail to be beneficial to the industry. In this connection, collecting centres, where the produce of many growers can be brought together, graded, packed and sold under one management, appear to offer advantages. Another suggestion is more extensive use of methods of preservation.

The Fluid Milk Market in England and Wales. *Ministry of Agriculture* (*Economic Series No.* 16). *Published by H.M. Stationery Office*, price 6d. net.

While this Report does not claim to deal with every phase of the milk trade, it presents a survey of the principal features which characterise the marketing of milk in England and Wales and contains suggestions of considerable interest. The central theme of the Report is woven round the low consumption of milk in this country. With the majority of foodstuffs, it is generally conceded that demand largely depends upon quality taken in relation to price, and while it is shown that the quality of the bulk of the milk in this country is relatively good, it is maintained that two fundamental aspects of the quality question require special attention. The first relates to the legal aspect of quality, and it is suggested that the existing law, relating to presumptive standards, be altered, in order to discriminate between deliberate adulteration and the sale of genuine milk below the limits prescribed. The second point deals with the present nomenclature of the grades which, it is contended, should be re-named in a manner which makes them more intelligible to the consumer. The subject of collective bargaining, which is strongly upheld as a sound and proper tendency, is also reviewed and examined in detail.

(13) PRESERVATION AND TRANSPORT.

LOW TEMPERATURE RESEARCH STATION, CAMBRIDGE.

BARKER (J.). **The Tomato in Cold Storage.** *Fruit Grower*, June 2nd, 1927.

This is an account of preliminary storage trials with English tomatoes at temperature ranging from 34° F. to 60° F.

CALLOW (E. H.). **The Presence of Formaldehyde in Wood Smoke and in Smoked Foodstuffs.** *The Analyst* (1927) Vol. lii, p. 391.

The presence of formaldehyde in wood smoke distillates was demonstrated in two ways, viz. :—

(1) by the preparation and identification of the di-β-napthol ether of formaldehyde,

(2) by Schryver's colour test (addition of 2 ccs. of a 1 per cent. solution of phenylhydrazine hydrochloride, 1 cc. of a 5 per cent solution of potassium ferricyanide and 4ccs. of conc. hydrochloric acid to 10 ccs. of the solution to be tested) which gives a brilliant magenta-like colour with formaldehyde.

Schryver's test was shown to be highly specific for formaldehyde. It was then used as a quantitative method to determine the amount of formaldehyde in smoked foodstuffs. For example the lean of unsmoked bacon was shown to contain no formaldehyde whilst the lean of smoked bacon contained up to 50 parts of formaldehyde per million parts.

CARRÉ (M. H.) & HORNE (A. S.). **An Investigation of the Behaviour of Pectic Materials in Apples and other Plant Tissues.** *Ann. Bot.* xli, 1927.

The results obtained from a microscopical study of the distribution and development changes undergone by the various pectic structures in the tissues of apples are correlated with those accruing from a parallel and purely chemical study of the pectic materials present in apples of the same varieties, derived from the same sources and kept under the same experimental conditions.

The methods adopted in this investigation have been applied to the study of the pectic changes which occur in apples in abnormal states, *e.g.*, physiological and fungal diseases and artificially induced conditions, and certain results of a preliminary nature are given.

KIDD (F.), WEST (C.), & KIDD (M. N.). **Gas Storage of Fruit.** *Special Report No.* 30 *of the Food Investigation Board, Dept. Scien. & Indust. Res.*, 1927.

This report is primarily a record of experiments. It deals with the effects produced by varying the amount of oxygen and carbon dioxide in the atmosphere upon the rate of senescence of living fruit, and hence upon time such fruit can be stored in good condition without wastage.

While it has been indisputably shown that an artificial atmosphere containing less oxygen and more carbon dioxide than is present in normal air retards the natural ripening processes of certain varieties of apples no general claims beyond the limits of the experiments actually described are put forward.

A very simple method of obtaining subnormal quantities of oxygen in the storage atmosphere, combined with an equivalent increase in carbon dioxide, is to enclose fruit in an air-tight chamber and regulate the amount of ventilation. With this method of gas storage, which may be termed the method of restricted and controlled ventilation, storage trials with apples (chiefly of the Bramley's Seedling, Stirling Castle and Lane's Prince Albert varieties) have been carried out over a number of seasons.

Onslow (M. W.) & Robinson (M. E.). **Oxidising Enzymes. ix. On the Mechanism of Plant Oxidases.** *Biochem. Journ.*, xx, 1926.

Confirms the observations of Szent-Györgyi, that an oxidation product, formed by the action of the oxygenase of the potato tuber on catechol, is capable of blueing guaiacum in the absence of peroxidase.

West (C.), & Smith (A. J. M.). **Overseas Transport of Apples. Importance of Efficient Cool Storage Arrangements at all Stages from Orchard to Consumer.** *Fruit Grower*, Mar. 3rd, 1927, p. 381.

Emphasises the importance of utilising cold storage not merely on board the transporting vessel but so far as possible at all stages between orchard and consumer. Discusses in turn the possibilities of (*a*) refrigeration before shipment, (*b*) more rapid cooling on board ship, (*c*) cooling during the period between arrival and consumption.

Report of the Food Investigation Board for the years 1925 and 1926. *H.M. Stationery Office*, 1927.

A brief summary of recent investigations is presented, including sections on (1) the transport of ham and bacon, (2) studies on freezing, (3) the storage life of apples in relation to respiratory activity and chemical composition, (4) factors affecting the internal resistance of apple tissues to fungal attack, (5) the development of bitter pit in stored apples, and, (6) storage investigations with fruit and vegetables.

(14) MISCELLANEOUS.

LONG ASHTON FRUIT RESEARCH STATION.

[Author] (Author.) The Use of Sulphur Dioxide as a Preservative in Cider. *Bath & West Journ.* 1926–27.

In consequence of the new regulations limiting the amount of sulphur dioxide allowed as a preservative in cider and perry and prohibiting the use of all other preservatives it has been considered desirable to investigate in detail the nature and mode of use of sulphur dioxide. Experiments have been carried out on the following different methods of using this preservative: (1) by burning sulphur matches in the casks; (2) as liquid sulphur dioxide; and (3) as a potassium salt.

The effects of varying doses and the rate of evolution of the sulphur dioxide in cider at each addition have been studied, also its action upon keeping quality, flavour, and other points of practical importance.

[Author] (Author.) Cider Making Trials for the Season 1925–26. *Bath & West Journ.* 1926–27.

The programme of experiments on cider making for the season 1925–26 was divided into two sections. The first was concerned with the continuation of trials of the vintage value of certain selected varieties of cider apples and its variation as relative to soil, season and other influences.

The trials of the second section comprised those made under the Cider Competition Scheme started in the previous year. The fruit used in the competitive is submitted by the growers and converted into cider under uniform conditions at the Institute. Seventy-five entries were dealt with in 1925–26. This scheme is designed to assist farmers to improve the standard of their orcharding, both by testing the vintage qualities of apples grown by them so that the varieties found to be inferior may be ultimately replaced by superior ones, and by demonstrating how their existing fruit can be handled most economically and thereby by encouraging greater care in the harvesting and subsequent treatment of the fruit. Already the scheme has proved its value by bringing to light some varieties of high promise which hitherto were practically unknown.

The third section of this department was devoted to further experiments on the practicability of the pasteurisation of juice and its subsequent fermentation with selected yeasts of yeast with the object of securing greater uniformity and control of fermentation and of overcoming or reducing the risks of the bacterial diseases to which cider is subject. In general the results have been of an encouraging character.

ROTHAMSTED EXPERIMENTAL STATION.

Fisher (R. A.) & Pearson (J.). On the Distribution of the error of an Interpolated Value, and on the construction of Tables. *Proc. Camb. Phil. Soc.*, Vol. xxiii, pp. 912–921.

The development of simple interpolation formulæ involving only even differences has favoured the unrequired use of formulæ of high order, while the theoretical study of the associated term makes it possible to assign tables by which such formulæ may generally be used. This paper develops the theory of the distribution of the error of interpolated values, and shows that these will always have a higher precision than the tabular entries, and if the errors of the tables are normally distributed and independent, those of the former will be normally distributed also with a standard which for high order formulæ tends to coincide. This will not be the case for tables correct to the nearest figure, to which the errors distributions of the tabular entries will be particularly discrete. Those of the interpolate will have a compounded distribution. The

advantages both in convenience and in precision of not cutting down tables as originally calculated, so as to be correct to the nearest figure are therefore to be considered in the publication of tables.

PURI (A. N.). **Investigations on the Behaviour of Hygrometric Hairs.** *Journ. Roy. Meteor. Soc.*, 1927, Vol. liii, pp. 115–125.

The determination of the relative humidity of the air is widespread in agricultural meteorology, and a hair hygrometer is often used for this purpose. Unfortunately the changes in length of a hair in atmospheres of different relative humidity, has not been sufficiently studied. The present paper, which is based on accurate measurements of a single hair under controlled conditions, has shown sources of error in the stock pattern instruments.

SOUTH-EASTERN AGRICULTURAL COLLEGE, WYE.

WARE (W. M.). **Frost Injury to Apples.** *Gard. Chron.* lxxxii, 154. Aug., 1927.

A description is given of injury, attributed to severe frosts at the end of April and beginning of May which resulted in blistering of the foliage and russetting of the fruit in a well-defined area around the "eye." A record of temperatures during April and May is given and illustrations of affected leaves and fruits. Such damage is rare in England.

Reference is made to publications containing similar descriptions from the United States and from Germany.

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